

SCIENCE

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FRIDAY, MAY 2, 1902.

THE AMERICAN PHILOSOPHICAL SOCIETY.

THE PRESIDENT'S ADDRESS.

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THE American Philosophical Society has conferred upon me the duty and pleasure of offering to you a hearty welcome to this General Meeting of the Society, and of expressing the gratification felt by all its resident members at the success which has rewarded their effort to assemble in this historic hall as many as possible of our non-resident members and friends from other parts of our country. Though widely separated as regards residence, and in the character of our labors, we are all of us as members warmly interested in the success and renown of our ancient Society. We who happen to live here know, and have always known, that our non-resident but fellow members, however distant they may be, constitute nevertheless as learned and accomplished a body of scholars as could be assembled anywhere. We know this partly from our limited opportunities of personal acquaintance, which we ardently hope may be more frequent hereafter, and we also know it as the world knows it, from their high distinction in science, from their published contributions to the world's knowledge, and as we gratefully acknowledge—from the abundant fruits of their labors sometimes contributed here, and which we take pleasure and pride in considering and discussing and giving to the

public in our printed *Transactions* and *Proceedings*.

As is doubtless well known to all here present, our Society is not, and never has been limited to one place of activity, or to the promotion of any particular branch of knowledge in preference to another. Its full corporate title, 'The American Philosophical Society held at Philadelphia for promoting useful knowledge,' has remained unchanged since the merger with it of the American Society in 1768, the last four words having been added on that occasion. Franklin's original circular urging its establishment was dated May 14, 1743 (old style), and was entitled 'A proposal for promoting useful knowledge among the British Plantations in America.' After suggesting the need for such a Society and proposing the name of 'The American Philosophical Society,' simply, it proceeded to recommend Philadelphia as the 'center of the Society,' because it was 'the city nearest to the center of the continent colonies, communicating with all of them northward and southward by post, and with all the islands by sea, and having the advantage of a good growing library.' That circular of 1743 now suggests some curious reflections. Though the adjective *continental* was apparently not yet coined, the text seems to intimate that of all the British possessions in America at that day, the 'islands,' that is the British West India Islands, were of equal or greater importance to Englishmen at home and abroad, than what it called 'the continent colonies,' meaning of course those continental settlements which had then received political charters of partial autonomy, but which have since grown out of comparison with any 'islands,' and by mutual association and union have expanded to a great nation, second to none in the ancient or modern world.

The reasons originally assigned for plac-

ing the Society's 'center' at Philadelphia, though then eminently and perhaps exclusively true of that place, seem extremely quaint to us moderns, who have become accustomed to seeing throughout our vast territory hundreds of libraries of greater dimensions and richer endowments than the 'good growing library' of 1743, and from whom the center of population has removed itself a thousand miles or more to what was then the heart of an unpopulated, unvisited and wholly unknown wilderness.

And yet, although the mighty changes of a hundred and sixty years have rendered no longer applicable Franklin's reasons for locating the seat, or as he called it the 'center' of the Society, it is nevertheless from those changes that we derive our chiefest compensation. It is true that we no longer find it necessary to enact as our earliest predecessors recommended, that there 'shall always be at Philadelphia at least seven members, viz., a physician, a botanist, a mathematician, a chemist, a mechanician, a geographer and a general natural philosopher, besides a president, treasurer and secretary.' During its long existence the Society has hitherto been able to enjoy such advantages without the constraint of law. It has been enabled to provide itself with officers—sometimes from an embarrassment of riches, and if our resident scholars should in any future emergency prove unequal to its necessities, we are happy in the assurance that our numerous non-resident members, dwelling in, and illuminating many parts of the world, might be relied on to come to its relief with an aggregate of wisdom and authority not inferior to the resources of the still more venerable Royal Society itself. Though our city remains in the same place and continues to appreciate and maintain the libraries, museums and institutions of our predecessors, it is no longer

'central' as regards any of these things, and has long ceased to be the only, or perhaps even the chief, seat of American learning. But if through the gratifying growth of other places it has sustained a relative decline, in scientific or any other eminence, it is because its methods, models and example have repeated themselves throughout the continent, until there is now scarcely a city that does not contain a center of intelligence and attainment radiating a fructifying influence far beyond its immediate vicinity.

We cannot keep the fact too plainly before us, that the work and influence of our Society were never meant to be local or confined to any one place, whether central or not. It aimed from its first act, to be continental in its influences, to encourage research everywhere as well as in its own vicinity. And if its originally avowed object—'the promotion of knowledge'—has been so successfully prosecuted as to plant younger and fresher centers of learning in every quarter of our country, what more glorious consummation could there be of the designs of our departed founders, and what more magnificent compensation to their successors who still prosecute their studies almost within the shadow of this ancient hall?

The Society desires to give the highest practical expression to its absolutely national character, and to adopt all methods which experience has shown to be most conducive to promoting the objects for which it was founded, and will gladly welcome at this meeting suggestions to that end. It has believed that an important step in that direction will be the holding annually a general meeting of its members from all parts of the country, of which the present meeting is the first. It is probable that such annual general meetings, supplemented by the facilities afforded by our ordinary semi-monthly meetings, will fulfil

many requirements of the intellectual activity of our members, while our *Transactions* and *Proceedings*, widely circulated among the scientific societies and workers of the world offer speedy and unexcelled avenues for publication.

During the hundred and sixty years of our existence vast changes have occurred in the population and economic conditions of our country. Besides the radical political changes of 1776—which indeed were accomplished within sound of my voice—there has occurred an increase of population and industry which is quite unique in modern times. A scanty littoral population which for want of adequate land communication, had long clung closely to the seacoast and its estuaries, becoming almost suddenly independent of the highways provided by nature, has expanded itself over a great continent with results undreamed of by the wisest of our ancestors who lived before the age of steam. Already this population has become the largest homogeneous people speaking a single language which now exists as a separate power, and there is no reason to doubt its continued future increase both in numbers and in homogeneity. Nor for that matter need we doubt that before life departs from our planet with the waning sun, but in a remote future, new ethnologists and archaeologists and perhaps even anatomists, will arise to dispute our homogeneity and will carefully study our origin, character and social structure, our language, civilization and religion, and the atrophy, exhaustion or catastrophe from which we shall perhaps have perished as a nation.

But it is not my purpose to occupy your time with speculations on past or present material affairs, except so far as they are inseparable from our intellectual history, because all such affairs are subordinate to and dependent upon the progress of mind and knowledge. Of all human agencies it

is these alone which have governed—and must always govern human affairs and human progress.

When I remind you that the life and labors of our Society have covered five generations as these are usually estimated, it is pertinent to remark that mere non-comparative figures convey but little definite apprehension to the mind unaccustomed to dealing with large numbers. When one of our justly distinguished astronomical members tells us that a given star is distant so many hundred millions of miles, the figures carry little real information to those of us who are not accustomed like him to consider such enormous numerals. But when he measures to us their equivalent in diameters of the earth's orbit, or proves that its light at known rates of motion must require some centuries to reach us, then we can get some notion of the results that he has reached in traversing the laborious march from hypothesis to demonstration. So, when we reflect that more than one of the sciences now best known had their first crude beginnings and earliest struggles in this hall, we get a more definite idea of the venerable age of our Society and the work that has been done here. If, for example, we turn to human anatomy, where our researches have so remarkably advanced our knowledge, it is true that dissections had been made, and the leading facts of structure, and even of function, ascertained before our Society was born. One might therefore suppose that human osteology at least—the knowledge of those essential and durable organs most prominent in all dissections—was then well known. And yet this Society had been in existence for more than half a century, when new bones and new parts and functions of bones were first discovered and described by one of our members in this room, which excited the interest and induced the correspondence

of such famous anatomists as Cuvier, Sömmerring and others.

Taking a glance at geology, it is probable that one of the most epochal books ever written prior to the vaster generalizations of Darwin, was that of Sir Charles Lyell. And yet even before the birth of Lyell, when Hutton and the early English geologists were first beginning to be dissatisfied with the Noachian deluge as the only available explanation of the phenomena they noted, fossil remains were examined and described in this hall, and the work of our members had no trivial share in guiding the world to the real solution. Our early geologists—like theirs—found that problematic deluge entirely inadequate to explain even such primitive facts as the existence of marine remains hundreds of miles from any then known ancient or modern seacoast, or the massive deposits of calcareous rocks containing marine shells and crustacea high up on mountain sides remote from the sea, or of the ripple marks, foot tracks and actual remains found embedded deeply in solid sandstone strata. Such early doubts and difficulties found appropriate and congenial place in the *Proceedings* of this Society, and Mr. Curtis in his recent life of Jefferson tells an amusing story in that connection.

The great statesman was at the same time president of the United States and of this Society, and sometimes professed to doubt which of those honors he valued most. He had covered the floor of a large room in the White House with miscellaneous fossil bones sent to him from Virginia, and had formed theories concerning them which were so unsatisfactory to himself that he begged one of his friends—a distinguished paleontologist of this Society—to come to Washington and examine them. A carriage journey from Philadelphia to Washington before the days of steam was no trifling

ordeal for a middle-aged philosopher, yet a room full of new fossils proved irresistible, the journey was performed, and the remains at once identified as those of *Elephas* and *Mastodon*, much to the disadvantage of Mr. Jefferson's theories.

The important science of electricity, of which during the past century we have but entered the threshold, as is well known, had its birth in this Society, and one might say in this room. It was here that Franklin first contrived his experiments, and by artificial means drew electricity from the clouds. It was here that he designed and constructed the first machine for obtaining it from terrestrial objects. It was here that it was constantly exhibited, studied and discussed, and since that day the Society has never lacked the presence and labors of a competent and distinguished body of its students and investigators. It is no fault of theirs that this great science, though studied by all the world for a century, has not yet been mastered. Notwithstanding our actual production or segregation of electricity on an enormous scale, and the astonishing practical uses to which it has been harnessed, we still know but little of its nature and origin, and almost nothing of the character and extent of its practical usefulness in the grand scheme of Nature. We have reason to believe that it pervades the cosmic universe, and suspect it of performing necessary functions not yet understood both in microscopic and cosmical economy.

And now after this brief glance at our far-reaching past and still briefer mention of some of the branches of knowledge which had here their birth or infancy, what can be said of the future? Here we may at once admit that the mysterious realms of ignorance still remain far more extensive than those to which the light of knowledge has been brought. Even the work that has been done invariably reveals

unexpected new work remaining to be done. We have catalogued hundreds of sciences whose names were unknown but a generation since. But though we have named and neatly labelled them and readily perceive their intimate relationship with their cousins both new and old, how much do we positively know of any of them? If we recur again to human anatomy—one of the oldest and best known of all, we find the world has been pondering it since the time of Aristotle, but all that it had learned of the prominent organs, their morphology, relations and functions, has been reduced to minimum relative importance, by the revelations through the microscope of the innumerable secrets yet to be learned. We now find how little we really know of tissues, cells, corpuscles, and above all of the still mysterious nervous system, the seat of all intelligence. Of the numerous cerebral nervous centers we have localized a few, but know little of the vast majority. We scarcely know what office or power to attribute to the 'convolutions' or what to withhold from them, and although we suspect much, yet in fact we know so little about them that their principal use to anatomists at the present time seems to be as receivers of hypothetical attributes of function which could not safely be loaded on anything else. Even if we confine our researches to the entire organ, can the anatomist tell us with certainty the structure and proportions of a normal brain, or can he define brain normality itself, and inform us what it is and how it may be known?

In fact after so many centuries of study, we may go even farther and enquire whether we are yet able to find any precise and intelligible definition for life itself. We describe it as 'conscious,' and 'reproductive.' But we now know that animal life exists which is apparently not conscious and is certainly not reproductive. And yet

though such life is neither conscious nor intelligent, it is seen to possess some quality, unknown and as yet incomprehensible to us, which is a fair equivalent for intelligence. In short it may even yet be safely said that if hundreds of volumes are required to contain our knowledge thousands would be necessary to catalogue our ignorances.

There remains then plenty of work to be done. No one who loves knowledge and is willing to work need ever want object or occupation. Nature's own operations have no more predominant characteristic than their extreme slowness, and it is not surprising that our most fruitful researches have in that respect imitated her deliberate and tentative evolutions. But it is encouraging to remember that whatever moves ceaselessly onward, losing no forward step and accumulating all its gains, must in time reach the goal. Though the masses of ignorance are still large and dark before us, knowledge does steadily accumulate on all our traversed paths. Time is long, and if we cultivate the same untiring patience which Nature has uniformly practiced in her gradual development of all things organic and inorganic, it is but a mathematical axiom that a day must come when we shall overtake her at her work—catch her, as it were, bare armed in her secret workshops, and claim undisputed heirship in all her works.

The grand results of that full and perfect knowledge which, though not for us as individuals, must come to our posterity, no mind now living can grasp or estimate. Recurring for illustration to the oft-quoted and somewhat ill-treated science of anatomy, when that day of complete and perfect knowledge shall arrive, when, for instance, our successors shall have traced out all its mysteries, localized every function, and identified every brain center and working cell, why should the future train-

ing of the individual be limited to the tedious imitative methods to which we are now confined? When with perfect knowledge we shall know how to treat all the centers of thought and will with wise discrimination, stimulating the good and repressing the bad, why should it not be possible to cultivate by unerring means intellect and even morals, to produce a great general or an honest statesman when he is most needed, to constitute a new society as superior to ours as we are to our humblest ancestors of primeval seas?

Let us not too hastily pronounce the sentence of extravagance against such hopes and speculations. To the generations of Galileo and Newton, of Laplace and Darwin, the first glimmerings of truth reached by those great leaders were equally startling. Yet in the lapse of time they have become established facts, on which the world of science plants itself with confidence as it moves forward to new conquests. Rather let us by every individual and associate effort preserve in full flower and fruit the vigor of our ancient Society as a center of continued labor. Let us encourage and stimulate each other in pressing on toward the attainment of complete knowledge. Because it is that, and that alone, which we cannot but observe, is destined to move onward and upward the world of life, and to maintain our human race in the primacy which it by no means always possessed, but is now claiming with no empty boasts.

ISAAC J. WISTAR.

THE GENERAL MEETING.

THE first general meeting of the American Philosophical Society was held in Philadelphia on April 3, 4 and 5, 1902. Founded by Benjamin Franklin in 1743 the Society is the oldest scientific organization in America devoted to the advancement of general knowledge; and although

it has always numbered among its members many of the most distinguished scholars of this and foreign lands, no concerted attempt had heretofore been made to bring together the general membership of the Society for the presentation and discussion of scientific papers. The success of this first general meeting has been so gratifying that it is almost certain that it will not be the last of its kind. About one hundred and twenty members of the Society were in attendance upon the meetings, of whom upwards of fifty came from places more or less distant from Philadelphia.

At the annual election held on the second day of the meeting the following persons were elected to membership in the Society:

RESIDENTS OF THE UNITED STATES.

John A. Brashear, Sc.D., Allegheny, Pa.

Acting Director of the Allegheny Observatory; Fellow of Royal Astronomical Society of Great Britain; Member of British Astronomical Association; of Société Astronomique de France, etc.; maker of astronomical and physical instruments of world-wide repute.

Andrew Carnegie, LL.D., New York.

Lord Rector of the University of St. Andrew; munificent contributor to the promotion of science, learning and the useful arts; founder and endower of the Carnegie Institution, at Washington, for the promotion of original research.

Professor William B. Clark, Baltimore.

Professor of Geology, Johns Hopkins University; State Geologist of Maryland; Associate-Editor of the *Journal of Geology*; author of numerous papers in publications of United States Geological Survey and Maryland Geological Survey and in scientific journals.

Professor Hermann Collitz, Ph.D., Bryn Mawr.

Professor of Comparative Philology and German at Bryn Mawr College; author of 'Sammlung der Griechischen Dialektinschriften,' and of many valuable philological contributions.

Grove K. Gilbert, Washington.

Past-President of the American Association for Advancement of Science; Member of National Academy of Sciences; Geologist in United States Geological Survey since 1879; in Ohio Survey,

1868-70; in Wheeler Survey, 1871-4; in Powell Survey, 1875-9. Author of 'Geology of the Henry Mountains' and of numerous reports and articles in publications of the United States Geological Survey.

President Arthur Twining Hadley, New Haven.

President of Yale University; of American Economic Association; Author of 'Railroad Transportation, its History and Laws,' 1885; 'Economics—An Account of the Relations between Private Property and Public Welfare,' 1876, etc.

Professor George E. Hale, Williams Bay, Wis.

Professor of Astrophysics and Director of the Yerkes Observatory, University of Chicago; author of many valuable papers on the sun, stellar spectroscopy, etc.

Professor Paul Haupt, Baltimore.

Professor of Semitic Languages in Johns Hopkins University; editor of the 'Polychrome Bible'; author of 'Sumarisch-Akkadische Keilschrifttexte,' 'Sumarische Familiengesetze,' 'die Akkadische Sprache,' etc., and of numerous papers on Biblical and Assyrian philology, history and archeology.

C. Hart Merriam, Washington.

Chief of the United States Biological Survey, Department of Agriculture; one of the most eminent of America mammalogists; author of several works and numerous papers on zoological and botanical subjects.

Professor Albert Abraham Michelson, Sc.D. (Cantab.), Chicago.

Head Professor of Physics in University of Chicago; Member of National Academy of Sciences; Fellow of Royal Astronomical Society; author of numerous valuable papers chiefly on researches in light.

Professor Theodore William Richards, Cambridge, Mass.

Professor of Chemistry in Harvard University; Member of National Academy of Sciences. Author of numerous papers concerning atomic weights and physical chemistry.

Professor Felix E. Schelling, Ph.D., Philadelphia.

Professor of History and English Literature in University of Pennsylvania; author of 'English Chronicle Plays'; editor of 'Book of Elizabethan Lyrics'; 'A Book of Seventeenth Century Lyrics'; etc.

Professor Robert Henry Thurston, Ithaca.

Professor of Mechanical Engineering, Stevens' Institute, 1871-85; Director of Sibley College, Cornell University, since 1885; first President of American Society of Mechanical Engineers; inventor of various valuable mechanical devices; author of about 20 volumes and some 300 scientific papers.

Benjamin Chew Tilghman, Philadelphia.

Manufacturing chemist and student of chemistry and physics; author of a monograph (as yet unpublished) on the chemical changes undergone by bones in passing from the living to the fossil condition.

Professor Robert S. Woodward, New York.

Professor of Mechanics in Columbia University; mathematician and astronomer of recognized eminence; Past-President of the American Association for Advancement of Science; President of American Mathematical Society, 1898-1900; Member of the National Academy of Sciences; author of numerous scientific papers on geodetic and astronomical topics.

FOREIGN RESIDENTS.

Antoine-Henri Becquerel, Paris, France.

Member of the Institut de France—Académie des Sciences; the third in descent of the French physicists of the name who have made themselves famous by their researches in science; his work has been chiefly in optics and magneto-optics; he discovered the uranium emanations, now called by his name, which led to the discovery of radium.

Jean-Gaston Darboux, Paris, France.

Perpetual Secretary of the Académie des Sciences—Section of Mathematics; eminent mathematician and author of numerous valuable papers on that subject.

Sir Michael Foster, F.R.S., D.C.L., Cambridge, Eng.

Secretary of the Royal Society; Professor of Physiology at Cambridge; Honorary Perpetual President of the International Congress of Physiologists; Chairman of the International Council in charge of the International Catalogue of Scientific Literature; President of British Association for Advancement of Science, 1899; author of 'Text-Book of Physiology,' and of other works; Joint-Editor of 'Scientific Memoirs of Thomas H. Huxley.'

Professor G. Johnstone Stoney, F.R.S., London, Eng.

Graduate of the University of Dublin and Fellow of Trinity College; formerly Astronomical Assistant to the Earl of Rosse, at Parsonstown, and subsequently Professor of Natural Philosophy in Queen's University; his papers upon the 'Physical Constitution of the Sun and Stars,' on the 'Internal Motion of Gases,' on 'Spectroscopy and Microscopy' have attracted universal attention.

Professor Silvanus P. Thompson, F.R.S., London, Eng.

Principal and Professor of Physics in City and Guilds Technical College, Finsbury; a well-known investigator in physics and an authority on electrical subjects; author of sundry technical works on electricity, and of 'Lectures on Light, Visible and Invisible.'

The sessions of the general meeting began on Thursday morning, April 5, in the historic hall of the Society in Independence Square, with an address of welcome by the president of the Society, General Isaac J. Wistar, in which he pointed out the broad and liberal character of the Society as indicated by the plans of its founder and the subsequent history of the Society, and also the important part which the Society has taken in the 'promotion of useful knowledge.' This address, which will be published in full elsewhere, was followed by the presentation of the following scientific papers, most of which will appear in the *Proceedings* and *Transactions* of the Society:

PROFESSOR JOHN B. HATCHER, of Pittsburgh, in a paper on the 'Origin of the Oligocene and Miocene Deposits of the Great Plains,' called attention to the great deposits of bones at various localities in the White River beds. He described them as literally covering the ground in places where they have weathered out over areas frequently of more than an acre in extent. It is not only difficult, but Professor Hatcher thinks impossible, to account for these accumulations of bones of terrestrial animals at the bottom and in the very

middle of a great lake. Since the surrounding clays are usually almost destitute of bones, it is difficult to understand how the dead carcasses of so many animals were driven or drawn as by a magnet to so limited an area. Accepting the other theory, however, we have seen how, during the rainy season, the deer, tapirs and other animals are driven to the islands over the flood plains of the great South American rivers. Since in exceptionally high freshets the lower of these islands become destroyed, it is not difficult to understand how great numbers of these animals must annually perish, and indeed it is a well-known fact that frequently great numbers of them are caught on low islands and, driven by the rising waters to more limited confines, they are finally all drowned when the island becomes entirely submerged. To such or similar conditions the great deposits of bones in the Oligocene and Miocene deposits of the West may owe their origin.

These facts, together with those brought forward by Dr. Matthew in his article 'Is the White River Tertiary an Æolian Formation' (*Am. Naturalist*, May, 1899), have driven Professor Hatcher, contrary to his earlier opinion, to reject the theory of a great lake and accept that of small lakes, flood-plains, river channels and higher grass-covered pampas as the conditions prevailing over this region in Oligocene and Miocene times.

MR. EARL DOUGLASS, of Princeton, in a communication on 'The Upper Cretaceous and Lower Tertiary Section of Central Montana,' pointed out that the finely exposed section of Cretaceous and Lower Tertiary rocks near the Musselshell River in Montana has been considerably affected by the disturbances that produced the mountains a little farther to the westward, so that erosion has exposed the different formations from what is apparently the Jurassic to the Torrejon. He maintained,

(1) that there are beds below the Fort Pierre, which have Laramie flora and fauna; (2) that the Livingston, Arapahoe and Denver beds correspond in age with the upper portions of what has been called Laramie; and (3) that the Fort Union beds are of the same age as the Torrejon in New Mexico.

PROFESSOR W. B. SCOTT, of Princeton, in a paper on 'South American Mammals,' confined his remarks to the Edentata of the Santa Cruz (Miocene) beds of Patagonia. Very curious is the absence from these beds of the existing families of the ant-eaters and the true or arboreal sloths, while armadillos, glyptodonts and ground-sloths are most abundantly represented. The armadillos are nearly all of aberrant type and very peculiar in some respects; only one species seems to be ancestral to a species of modern times.

The glyptodonts are very small and in remarkable contrast to the giant forms of the Pleistocene.

The ground-sloths are relatively small, as compared with the huge representatives of this group which in Pleistocene times spread over nearly the whole of North and South America. In the Santa Cruz beds are found the probable ancestors of nearly all the Pleistocene genera. Of especial interest on this occasion is the newly discovered genus which seems to be the ancestor of *Megalonyx*. The latter was first discovered by President Thomas Jefferson and described in an early volume of the *Transactions* of this Society.

SAMUEL N. RHOADES, of Audubon, N. J., in a paper on the 'Mammals of Pennsylvania and New Jersey,' said that Pennsylvania and New Jersey, on account of their geographic position and the consequent variety of the faunal environments afforded by the two extremes of the elevated Alleghanian summits and the sandy maritime plains of the southeastern coast line,

present a relatively large and varied list of land and sea mammalia. These number in existing native species and races ninety-five, of which seventy-seven are terrestrial or amphibious, and eighteen are aquatic.

The extinct mammalian fauna of the two states is remarkably large, exceeding greatly that of the entire remainder of the United States east of the Mississippi River. Of extinct terrestrial mammalia there have been described, mainly from the limestone bone caves and fissures of the Pleistocene horizon in the lower Delaware Valley, ninety-one species. These include such tropical genera as the giant sloth, rhinoceros, tapir, elephant, manatee and saber-toothed tiger, as well as arctic forms now only existent in Canadian regions, such as the reindeer, moose, musk ox and walrus. From the marl beds of New Jersey nine species of whales, referable with one exception to the tropical shark-toothed family now existing in the Indian Ocean, have been described.

Comparing the two lists, the remarkable fact is shown that in Pennsylvania and New Jersey the list of extinct species of mammals known to us equals, if not exceeds, that of the existing species. In contrast to this New York in Miller's recent list only boasts of five species of known extinct mammalian species.

The effect of deforestation by axe and fire, and its consequent radical alteration of climatic conditions even in the most inaccessible parts of the Alleghanian wilderness at the present day, has done much more to alter the faunal status than all other destructive agencies combined. In consequence many of the least known of the smaller mammalia approach extinction. Of the larger, the native wapiti, bison, beaver, cougar, wolf and wolverine, some of which lingered far into the last century in Pennsylvania are now exterminated.

DR. FREDERICK W. TRUE, of Washington,

in a communication on 'The Identity of the Whalebone Whales of the Western North Atlantic,' summarized the results of an extensive investigation of the whalebone whales of the Atlantic coast of North America carried on under the U. S. National Museum, the principal object being to ascertain whether the species which occur in American waters are the same as those known to frequent the coast of Europe, and thus to provide a more trustworthy basis for the study of the geographical distribution of these animals. The American species were found to be the same as those of Europe, but the European finback whale known as Rudolph's Rorqual, *Balænoptera borealis* Lesson, has not been found in American waters. The species occurring on the east coast of North America are as follows:

Greenland whale or Arctic right whale, *Balæna mysticetus* (L.).

Black whale, or the right whale of the Temperate North Atlantic, *Balæna glacialis* (Bonnaterre).

Humpback, *Megaptera nodosa* (Bonnaterre).

Common finback, *Balænoptera physalus* (L.).

Sulphurbottom, *Balænoptera musculus* (L.).

Little piked whale, or lesser finback, *Balænoptera acutorostrata* (Lac.).

AFTERNOON SESSION.

PROFESSOR H. VON IHERING, of São Paulo, Brazil, in a paper on the 'Molluscan Fauna of the Patagonian Formation,' which was presented by Professor W. B. Scott, described two of the most striking of the many new species contained in the large collection made under his direction.

PROFESSOR EDWARD S. MORSE, of Salem, Mass., in a 'Comparison between the Ancient and Recent Molluscan Fauna of New England,' said that the results of observations and measurements of the species of shells found in the shell heaps of New England, in comparison with the shells of the same species found living to-day in close proximity to the deposits and presumably

their descendants show in every case a change in the proportionate diameters. As an illustration, the common clam, *Mya arenaria*, found in the shell heaps has a greater height in proportion to its length than that of the recent forms. This index is higher north of Cape Cod, both in the ancient and recent. The same differences are found in Japan and in England. The index is very much higher in the glacial deposits. For this and other reasons the change in the index is correlated with temperature.

It is furthermore pointed out that related forms in Japan and New England had changed in precisely the same manner. Full details with tables of measurements will be given in the memoir on the subject.

PROFESSOR ARNOLD E. ORTMANN, of Princeton, in a paper on the 'Distribution of Fresh Water Decapods and its Bearing upon Ancient Geography,' said that the present and former distribution of these animals suggested the following land connections in former times:

1. Northeastern Asia with northwestern America, across Bering Sea.
2. East Asia (Sinic Continent) with Australia, over the Malaysian islands.
3. South Asia and Africa, by way of Madagascar.
4. New Zealand with Australia, by way of New Caledonia and New Guinea.
5. Australia with Antarctica, and Antarctica with South America (Archiplata).
6. The Greater Antilles with Central America.
7. Africa with South America (Archibrazilia).

PROFESSOR W. M. DAVIS, of Cambridge, in a paper on 'Systematic Geography,' said that the accumulation of an ever-increasing store of facts under the broad subject of geography makes it desirable to establish a classification with respect to which the facts may be arranged, not only for the

convenience of putting them away in good order and of readily finding them again when wanted, but even more for the sake of the better understanding that comes from association and correlation. Geographical classification may be by kinds or by places, systematic or regional; but the first should precede the second. The first provides a scheme whereby all similar items, whatever their place of occurrence, may be brought together under a single category; the second describes all the items of a certain region as examples of known categories, and presents them in an order that expresses their systematic relationships. There is to-day no precise agreement as to the total content of geography, much less as to the subdivision and systematic arrangement of its parts; but if the study of the earth in relation to its inhabitants be taken as a sufficient definition of the subject, its prime divisions must be the physical environment of organisms and the responses of the organisms to their environment. Each of these divisions is then to be subdivided into many categories, and each category is to be rationally described, to be illustrated by typical examples, and to be traced through its relationship to the categories of the other prime divisions of the subject. The innumerable relationships thus disclosed constitute the subject of geography proper, and it is as an aid to their systematic treatment that the proposed classification of the subject as a whole is undertaken.

MR. HENRY G. BRYANT, of Philadelphia, in his paper entitled 'Drift Casks in the Arctic Ocean,' gave the present status of an experiment worked up by Admiral George W. Melville, U. S. N., and himself, which aimed to test the speed and direction of Arctic currents by means of a series of drift casks set adrift in the Arctic Sea north of Alaska. He called attention to the fact that the scheme was the outcome

of the Nansen Meeting of the American Philosophical Society held in 1897, on which occasion Admiral Melville called attention to the feasibility of a plan to ascertain the speed of ocean currents in the circumpolar regions by setting adrift a series of especially constructed, spindle-shaped casks in the waters north of Bering Strait and in other parts of the Arctic Ocean.

This proposed method of studying Arctic currents without endangering human life was brought to the attention of the Geographical Society of Philadelphia and that body determined to undertake the project. Fifty casks of special shape, to escape crushing by ice pressure and covered with a coating of black water-proofing material were made in San Francisco. Messages printed on linoleum paper by a permanent blue-print process, which renders them impervious to salt water, were provided. These messages were printed in the English, Norwegian, German and French languages and embodied the following particulars: (a) Name of vessel and master assisting in the distribution, date, number of cask and latitude and longitude of point where it was set adrift; (b) direction as to filling in record and sealing up tube; (c) blank space for insertion of name of finder, date and locality where cask was picked up; (d) clause requesting finder to notify the nearest U. S. Consul or to send direct to the Geographical Society of Philadelphia. Accompanying each consignment of casks was a set of printed instructions to masters of vessels engaged in their distribution.

In the hazardous work of distributing the casks assistance was rendered by the U. S. Revenue Cutter *Bear* and the vessels of the whaling fleet sailing from San Francisco. Mr. Bryant stated that reports of the accomplishment of the preliminary work have come in rather slowly, owing to

the length of the whaling voyages. The work of distribution had begun in 1899 and reports were still coming in from the whaling captains. To date, thirty-five casks had been launched in the far North and fifteen remained yet to be heard from.

It has been known for years that no appreciable amount of water from the polar ocean escaped through the narrow, shallow outlet of Bering Strait, while the knowledge gained from the drift of the *Jeannette* and *Fram* points to the existence of a well-defined drift across the circumpolar area to the shores of Franz Joseph Land, Spitzbergen and East Greenland. The presence of quantities of Siberian driftwood in the localities named can be explained by no other intelligent hypothesis, while it is well known that Dr. Nansen based the theory of his voyage primarily on the finding of the *Jeannette* relics on the west coast of Greenland, three years after the crushing of that vessel in the sea northeast of the New Siberian Islands.

From the nature of the case, it is difficult to prophesy the time that will be required to complete the drift, but it is safe to assume that from three to five years will be required by the casks to make the journey across the polar basin.

MR. JOSEPH WHARTON, of Philadelphia, speaking of 'The Magnetic Properties of Nickel,' said that this metal is capable of being made permanently magnetic. He made a horseshoe magnet and ship compasses of nickel for the Centennial Exposition of 1876, and sent compasses to the American, British, French and Russian governments for experiment on shipboard. The United States and English officials paid no attention to the matter, but the other countries named made official investigations, indicating, among other things, that pure nickel shows a very considerable permanent magnetism—about one half as much as hardened steel.

In the evening session, President HENRY S. PRITCHETT, of the Massachusetts Institute of Technology, spoke on 'The Relation of the American University to Science,' and President DANIEL C. GILMAN, of the Carnegie Institution, on 'The Advancement of Knowledge by the Aid of the Carnegie Institution.' These addresses were followed by a public reception at the Museum of Science and Art, given in honor of the members of the Society by the Department of Archeology of the University of Pennsylvania.

FRIDAY MORNING SESSION.

PROFESSOR T. J. J. SEE, of Washington, in a 'Historical Investigation of the Supposed Changes in the Color of Sirius since the Epoch of the Greeks and Romans,' pointed out that the highest authorities of antiquity attributed to Sirius a ruddy color, and that there is no authority who says that the star was white, and that it has become white since the time of the Roman emperors—perhaps since the end of the fourth century. The star may have changed color very suddenly, or its redness may have gradually faded with the centuries and disappeared slowly like the ancient civilization. In modern times the star has always appeared white, and there is therefore no suspicion that the color changes periodically. The redness of a star's light depends, without doubt, mainly upon selective absorption; accordingly, the natural explanation of this change of color would seem to be a change in its atmosphere.

PROFESSOR ERNEST W. BROWN, of Haverford, Pa., in a paper on 'Recent Progress in the Lunar Theory,' gave a general account of the lines along which investigation has proceeded during the last thirty years. The work of Dr. G. W. Hill on periodic orbits was the starting point of the investigation undertaken by M. Poincaré. The investigations of the latter on diver-

gent series were also referred to. The second part of the paper contained an account of the progress made towards verifying the law of the inverse square. The writer also gave an account in some further remarks of the progress made in the theory which he is now working out. He pointed out in what way it might settle some outstanding difficulties.

PROFESSOR M. B. SNYDER, of Philadelphia, in a paper 'On a new Method of Transiting Stars,' described a method of driving the ordinary micrometer screw of the transit instrument by means of a small electric motor to the speed pertaining to any given declination, at the same time that the observer by a secondary adjustment of the position of the wire secures and maintains bisection of the star, and an automatic record of given positions of the screw is made on a chronograph. The Repsold method of alternately twirling the screw of a specially constructed micrometer was held to be radically defective in important particulars. Various devices for accomplishing the electrical method of driving and of regulating the motion of the screw of the transit micrometer, as well as the actual arrangement in use at the Philadelphia Observatory, called for brevity a 'transiter,' were described. The transiter seemed to furnish all the necessary facilities of motion and of recording, and not only permitted elimination of all errors excepting that of bisection, but for the first time allowed of the direct determination of absolute personal equation upon the stars themselves at all transits where this might be desired.

MR. PERCIVAL LOWELL, of Flagstaff, Ariz., spoke on 'The Evolution of Martian Topography.' He said that one of the great causes of misapprehension and contradictions in former observations of Mars is that the planet looks differently in winter and summer. The dark patches

were called seas, but it has been found that there are no seas on Mars. There are no large bodies of water, and the question is: Are there even small ones? The surface is vastly different from that of the earth, in that it is apparently all land, but there is a strange similarity in the air currents.

He described the investigations of Schiaparelli and others and deduced evidence that the so-called canals are vegetation.

Mars is passing, like the earth and the moon, through a process of drying up. It is not as far advanced as the moon, where there is no moisture or atmosphere, but it is farther advanced than we are.

PROFESSOR CHAS. L. DOOLITTLE, of Philadelphia, presented a paper on 'Results of Observations with the Zenith Telescope at the Sayre Observatory.' In 1876 was begun at the observatory erected by Robert H. Sayre at South Bethlehem, Pa., a series of 'Latitude Observations' which was continued with considerable interruptions until August 19, 1895. The final results of the latter part of this series, from January 19, 1894, till the close, were published in full about one year ago.

The present communication, which concerns the earlier portion of this work, comprised three sections or subdivisions.

1. Investigation of the right ascensions and declinations of the stars employed in the latitude work—254 in all.

2. Results of latitude observation from 1876 to 1891—2,623 determinations.

3. Results of observations from October 10, 1892, to December 27, 1893—2,900 determinations.

In section 2 the latitude determinations discussed are distributed very unequally through the years 1876, '77, '78, '85, '86, '88, '89 and '90. With the exception of those of 1889-90, they are not well adapted to an investigation of the periodic changes of the latitude.

The investigation of the constant of aberrations was contemplated in planning the work of 1889-90 and that of 1892-93, though it was at that time regarded as a kind of by-product. Each observation furnishes one equation for this purpose. The 2,900 equations of the latter series were combined by a process of 'bunching' to form 190 separate equations, which were solved in the usual way, giving for the aberration constant the final value

$$20.''551 \pm .009.$$

A peculiar feature of the latitude values is a progressive diminution of the mean value.

Thus we have the following mean results:

1876-78	Latitude=	40°	36'	23.81"
1889-90		40°	36'	23.41"
1892-93		40°	36'	23.11"

No satisfactory explanation of this apparent diminution has been found.

PROFESSOR JOHN TROWBRIDGE, of Cambridge, presented an interesting paper on the 'Spectra of Gases at High Temperature,' which was illustrated by a series of lantern slides. He called attention to his discovery of dark lines in the spectra of gases not due to absorption, which do not change the silver salt and which give therefore bright lines on the negative. This shows that there are rates of vibration to which the photographic plate does not respond. This discovery leads us to believe that the solar spectrum is probably far more complex even than we have supposed.

AFTERNOON SESSION.

PROFESSOR A. STANLEY MACKENZIE, of Bryn Mawr, presented a paper, entitled, 'On Some Equations Pertaining to the Propagation of Heat in an Infinite Medium,' in which attention was called to the necessity of trying to interpret in terms of physical conceptions all the mathematical

operations used in the analytical treatment of physical problems. The inherent physical meaning of each step in the treatment should be made evident, and the general nature of the result of each step should be capable of prediction; this may not always be possible, but it is rather more common than not, to avoid such interpretations. The paper dealt with these points as illustrated in the study of heat conduction (or in eabling), and pointed out the importance of that subject for its pedagogical value in mathematical physics. Beginning with the solution for the periodic distribution of temperature about a point, the solutions for other problems were built up, each step in the analysis being first discussed as to its physical interpretation, and the relationships of the various solutions brought out. In this way was developed the meaning of many of the common operations involved, the possibility of their being solutions, and finally the interpretation of a Fourier's integral. Among other things, careful drawings were exhibited of the curves for temperature and current for the more important equations.

PROFESSOR M. I. PUPIN, of Columbia University, New York, in a paper on 'The Law of Magnetic Hysteresis,' presented an account of a mathematical and experimental research upon the magnetic properties of iron which resulted in the discovery of a new law in magnetism. This law can be stated as follows:

"The heat generated per unit volume of iron during a cycle of magnetization is proportional to the cube of magnetic intensity."

This law holds true within the first of the three well-known intervals of magnetization. It was discovered by determining accurately the resistance of the magnetizing helix, employing vibratory magnetizing forces of about 1,000 periods per second, and then separating the various compo-

nents of this resistance by means of mathematical analysis.

This investigation is an extension of the researches of Professor Ewing of Cambridge University, England, and of Lord Rayleigh, employing a new and very much more sensitive method. Its results have a very important practical bearing in the manufacture of inductance coils. From its purely scientific aspect the new law derives its principal interest from the fact that it will materially assist in the formulation of the physical theory of magnetism.

PROFESSOR W. K. BROOKS, of Baltimore, presented a one-minute paper on the subject 'Is Scientific Naturalism Fatalism?' It is impossible to fairly report this paper, already admirably condensed, without presenting it in its entirety. It may be said, however, that, basing his opinion on well-known views of Hume and Berkeley, the author maintained that certainty in the natural world does not imply necessity in the agent.

Professor Brooks also presented a paper, illustrated by drawings and models, on '*Dichotoma*, a New Genus of Hydroid Jelly-fish,' found in the Bahamas, which shows many resemblances to a fossil form described by Walcott from the Lower Cambrian.

PROFESSOR HENRY KRAEMER, of Philadelphia, in a paper 'On the Continuity of Protoplasm,' which was illustrated by lantern slides, said that a starch grain consists of alternate layers of colloidal and crystalloidal substances, and that the colloidal layers are the ones which take up the various aniline dyes, as gentian violet, eosin, safranin, etc. The various clefts and fissures produced in the grains behave toward staining reagents much like the colloidal layers, and they are probably the tracts or channels through which liquids are distributed throughout the grain. The author has observed that by the use of

various swelling reagents a similar layering is produced in the walls of endosperm and stone cells and that the structure is physically quite similar to, although chemically different from, that of the starch grain.

In continuing these observations on the cell wall, using staining agents in connection with swelling substances, including sulphuric acid, the author finds a close similarity in the appearance produced in the thick-walled endosperm cells in the date, vegetable ivory and nux vomica, and is inclined to consider that the appearance produced in the walls of these and other cells, which has given rise to the widespread conclusion that it indicates a continuity of protoplasm, has a close relation to the colloidal layers and clefts in the starch grain which take up staining reagents. Furthermore, the protoplasm in the cells of vegetable ivory is frequently stained an entirely different color from that of the so-called threads of protoplasm. In nux vomica the threads are interrupted and in vegetable ivory they are peculiarly curved, indicating an alteration of the cell wall, which condition is very pronounced in some of the thinner sections.

PROFESSOR EDWIN G. CONKLIN, of Philadelphia, presented, with lantern slide illustrations, a brief synopsis of a paper on the 'Embryology of a Brachiopod, *Terebratulina septentrionalis*.' The early development of this animal is unlike that of annelids and mollusks, though the larvæ belong to the Trochophore type. The larvæ of this brachiopod closely resemble those of *Phoronis* and show certain likenesses to the Polyzoa. All three of these groups should be classed together in a phylum distinct from the Annelida, Mollusca or Chætonatha.

PROFESSOR THOS. H. MONTGOMERY, JR., of Philadelphia, presented in a paper on 'The Relationship of the Gordiacea,' a

brief abstract of an anatomical memoir on the genus *Paragordius*. The conclusion reached from a study of the adult structure is that the Gordiacea are neither Annelida nor Nematoda, but in most points of structure appear to represent a phylum distinct from both of these.

DR. M. LOUISE NICHOLS, of Philadelphia (introduced by Professor Conklin), presented a brief synopsis of a paper on the 'Spermatogenesis of *Oniscus asellus*, with especial reference to the History of the Chromatin.' The first of the two maturation divisions in this animal is reducing. The spermatids become associated in groups to form sperm colonies, each of which is flagellate at its anterior extremity.

DR. CYRUS ADLER, of Washington, presented a communication on the plans and purposes of the 'International Catalogue of Scientific Literature,' and exhibited advanced sheets of one of the volumes now being published.

SATURDAY, APRIL 5.

PROFESSOR LINDLEY M. KEASBEY, of Bryn Mawr, in a paper entitled 'A Classification of Economies,' defined an economy as a system of activities whereby the potential utilities inherent in the environment are, through utilization, converted into actual utilities. In working out a classification, economies, he said, can be distinguished from each other in two ways: Subjectively, according to the incentive leading to utilization, and objectively, according to the means employed in the process. Applying this canon of distinction, we can distinguish between the *automatic economy* characteristic of plant life, the *instinctive economy* characteristic of animal life, and the *rational economy* characteristic of human life. The course of human development also exhibits three characteristic types of economies: First the *acquisitive economy*, where the motive making for utilization is

the acquisition of use values, and the means employed in the process consist of artificial implements that can be worked with the hand. Second, the *proprietary economy*, where the motive is to add to one's possessions or acquire proprietary values, and the means employed in the process consist of agricultural capital, *e. g.*, domesticated herds and cultivated fields. Third, the *commercial economy*, where the motive is the acquisition of exchange values, and the means employed in the process consist of industrial capital, *e. g.*, buildings, shops, ships, machines, etc.

For each of these three types of economies there is a corresponding organization of industry. The organization adapted to the acquisitive economy is cooperative; that adapted to the proprietary economy is coercive; and that adapted to the commercial economy is competitive.

Having established the three fundamental types of economies, the classification may be carried further by taking the several processes of production and the several systems of distribution and exchange into account.

DR. SIMON FLEXNER, of Philadelphia, reported upon some 'Experiments in Cytolysis.' There has been great activity, he said, in the study of the conditions under which tissue and blood cells undergo solution. For the blood cells it has been demonstrated that various agents—chemical, physical and biological—bring about solution—the so-called hæmolysis. The first two agencies act by disturbing osmosis within the cells; biological solution—that produced by foreign blood sera—is produced through a fermentative action (Ehrlich) in which two sets of substances are required. The substances are denominated intermediary body (receptor) and complement, and are normally present in active sera. Should the intermediary body (receptor) be absent, it can be pro-

duced by the treatment of animals with blood cells in a manner analogous to the immunization to bacteria. Similar intermediary bodies capable of uniting with appropriate complements can be produced for most or all body cells. In that they are destructive for the specific cells through which they have been produced, they are termed 'cytotoxins.' The most active are the heterocytotoxins, produced in alien animals; but less active isocytotoxins are known and in a few instances autocytotoxins for blood cells have been produced. Hitherto the study of the histological changes produced by cytotoxins has been little pursued. The author has prepared cytotoxins for lymphatic gland cells and injected the product into animals of the class from which they were prepared, with the result of causing definite histological changes in the corresponding tissue. The changes consist of necrosis and multiplication of the cells of the germinal centers, giving rise to appearances indistinguishable from those produced by well-known bacterial toxins, such as the toxins of the diphtheria bacillus and streptococcus, and the toxins ricin and abrin derived from the higher plants.

PROFESSOR A. C. ABBOTT, of Philadelphia, presented a paper prepared by himself and Dr. D. H. Bergey, on 'The Influence of Alcoholic Intoxication upon Certain Factors concerned in the Phenomena of Hæmolysis and Bacteriolysis.' The authors' experiments indicate that the increased susceptibility to infection seen in alcoholized rabbits is, in part at least, explainable through a reduction in the amount of 'protective proteids,' normally present in the blood. They found the power of restoring to a heated immune serum its hæmolytic property to be from fifteen to twenty-five per cent. less in the serum from alcoholized than in that from normal rabbits. This they interpret as a

reduction of the usually present ferment-like 'complement' of Ehrlich and Morgenroth, a body regarded by those authors as essential to the mechanism of vital resistance to infection.

PROFESSOR J. C. WILSON, in a paper on 'Osteitis deformans,' communicated some facts in regard to this rare disease which was first described by Paget in 1877. He thought it might be due to (1) infection by some organism to the action of which bone tissue is especially liable, or (2) to the default of some physiological principle which normally regulates and limits the growth of bone. Either of these views may serve as a working hypothesis for investigations into the causes of the disease.

PROFESSOR LEWIS M. HAUPT, of Philadelphia, a member of the Isthmian Canal Commission, presented a paper, fully illustrated by lantern slides, on the proposed 'Isthmian Canals.'

PROFESSOR M. D. LEARNED, of Philadelphia, presented the final paper of the meeting on 'Race Elements in American Civilization and an Ethnographical Survey of the Country.' This paper presented in condensed form the importance of a thorough investigation of the race elements in our American life and institutions, with illustrations from the influence of the German element upon American agriculture, industry, trades, commerce and particularly upon our educational and scientific methods, our social and economical life and our art and literature.

The plan of an 'Ethnographical Survey' has already assumed practical form, and an expedition is being equipped for the coming vacation. The work will furnish data of wide range, on the survivals of early German culture, the architecture, geographical distribution, migration of early settlers and the present economic, sociological, in-

dustrial and other cultural conditions of the German element.

The social features of the meeting were most enjoyable. Luncheon was furnished at the hall of the Society on Thursday and Friday and many opportunities were afforded for making and renewing acquaintances. On Thursday evening a largely attended reception was given in honor of the members of the Society at the University of Pennsylvania. On Friday evening the visiting members were the guests of the resident members at dinner at the Hotel Bellevue on which occasion one hundred and eighteen members were present. At the close of the dinner Professor W. B. Scott, acting as toastmaster, introduced in happy vein the persons named below, who responded ably and delightfully to the following toasts: 'The Memory of our Founder,' Mr. Samuel Dickson; 'Our Sister Societies,' Professors Edward S. Morse and J. McKeen Cattell; 'Our Universities,' President Francis L. Patton and President Ira Remsen; 'The Future of Science,' Dr. Wm. Osler; 'Our Guests,' Professor H. Morse Stephens.

At the close of his remarks Professor Stephens proposed a toast to 'The Health and Continued Prosperity of the American Philosophical Society,' in which all present joined.

OUR SISTER SOCIETIES.*

I REALIZE the honor of being asked to respond for the National Academy of Sciences to the toast 'Our Sister Societies.' In a sense the National Academy of Sciences may be considered more intimately related than a sister, for on its organization and incorporation by the National Government in 1863 we find among its fifty members forming the corporate body the largest number from any one place were

* Speech at the dinner on the occasion of the recent general meeting of the American Philosophical Society.

Philadelphians, and all of these were members of the American Philosophical Society. Its first president was one of your number as well as one of your presidents—Alexander Dallas Bache; and the man who was intrusted with the treasurership was another Philadelphian, and a member of your society—Fairman Rogers. More than half its members to-day are members of your Society. There is every reason why the two societies should be strongly affiliated; they are both working in the same spirit and in similar departments of research, and for a similar purpose—the advancement of science; and in that advancement of science the question is never asked whether it will be for the benefit of man or not. Cherished beliefs are shaken, dreadful doubts are engendered, but mysterious is the fact that the advancement of truth and knowledge tends to the bettering of man's condition. The duration of human life has been lengthened, the hours of labor shortened and an advance in human comfort has been attained. Plagues have been confined to those countries where fetich worship takes the place of observation. These, however, are trite and well-worn statements. What we should ask ourselves is, have the sister societies any other duties beside those of accumulating museum material and publishing transactions? With the knowledge embodied in these publications should we not in some way convey the results of our methods to the masses?

The aggressive actions of the temperance advocates have gone so far as to prepare and cause to be introduced into our common schools text-books urging their cult in a way that, considering the mission of the societies, is decidedly intemperate. Following their example we shall have forced upon us by ignorant school boards pleas for anti-vaccination. With the record of a hundred thousand astrologer's almanacs

sold in London last year and the cultured city of Boston supporting astrologers and clairvoyants by the score, as attested by the advertising space accorded them in the daily press we may look forward for text-books on palmistry, astrology and the like in the near future. Should not an effort be made to formulate principles which underlie phenomena? Quetelet insisted upon the value of large numbers whether in measurements or statistics. A child should be made to understand the value of averages, the importance of a curve. Let us have a text-book on civil service reform. On the hundredth anniversary of your incorporation, in 1880, one of your members, Mr. Snowden, Chief of the United States Mint, made an admirable address on the necessity of civil service. This was buried in the records of that great meeting. Consider how graphically the principles he urged could be placed before the grammar school classes. Such an exposition would be prefaced by the great principle of natural selection with its fascinating illustrations from the animal kingdom. The economy of civil service could be shown in that we directly select the fittest without first killing nine tenths of the population. It would not be amiss to show how near we are to the barbarian in many ways, in that we do not profit by example. We contemplate with delight the perfectly governed cities of Birmingham and Berlin, we see the great reduction in the death rate by the introduction of pure water in Munich and in ten great cities of Great Britain, yet, with an equally intelligent population in our country, consider the management of some of our great cities in these matters.

In some way should be brought to the comprehension of the masses the relation of quantity and quality. I have elsewhere called attention to the absurd contrasts often made in the public press to illustrate

the magnificence and grandeur of our country. We are told, for example, that Texas is larger than the whole of Europe, not including Russia, yet if Texas were concentrated to a square rood it would not contain as much art, science or music as may be found in many of the hundred smaller towns of Germany. We are told that the two Dakotas are as large as Greece. This comparison is as ludicrous as to say that Daniel Lambert was six times as large a man as Raphael. A bound volume of the *Bloody Gulch News* might exceed in weight and size the first folio of Shakespeare, a crematory for garbage might have a chimney exceeding in height Bunker Hill Monument. These are the kinds of figures we are told our boys and girls should know. Our people need to be taught the true value of comparison. They will be none the less patriotic, but they will be the more eager to establish and sustain with generous hand those kinds of institutions which make Europe so attractive to every intelligent American. Precisely how this work is to be accomplished I do not know, but it would seem that scientific societies, by the appointment of committees, should embody the principles of science so that the young mind may gradually grow to a comprehension of the right way of living and thinking. There is a scientific way of dealing with crime and vagabondage; there is a scientific way of administering charities, there may be a way of showing the survival in the human mind of belief in omens and dreams; and the child should be taught to appreciate the condition of a man, otherwise intelligent, in whose brain there survive a few molecules that lead him to believe in hallucinations. Even at the present time we see surviving in a few brains the ancient and almost universal belief that the world is flat.

This work should be international. We have so many international agreements,

such as signals at sea, longitude and latitude and an international postal union; let us have international text-books to make the twentieth century leave its fetiches, its idiocies, its enslavements to the vagaries belonging to the imagination, and realize, in the words of Huxley, that 'Science is teaching the world that the ultimate court of appeal is observation and experiment and not authority, she is teaching it to estimate the value of evidence, she is creating a firm and living faith in the existence of immutable moral and physical laws, perfect obedience to which is the highest possible aim of an intelligent being.'

EDWARD S. MORSE.

SCIENTIFIC BOOKS.

Inductive Sociology, a Syllabus of Methods, Analyses and Classifications, and Provisionally Formulated Laws. By FRANKLIN HENRY GIDDINGS, Ph.D., LL.D., Professor in Columbia University. New York, The Macmillan Co. Pp. xviii + 302.

A new book by Professor Giddings is an event of first-rate importance among the sociologists. The present volume is notable not merely because anything produced by its author is bound to attract attention. It is in many respects the maturest and most important of his publications. One fact among others will be better appreciated within the craft than among other specialists. Professor Giddings has very pronounced peculiarities of view with respect to both material and method of sociology. In the present volume those peculiarities stand out more distinctly than ever. Their reception by the sociologists is likely to be much more tolerant, and even sympathetic, than could have been the case ten years ago. This indicates not so much that Professor Giddings' views will be accepted, as that differences which seemed essential ten years ago have come to be regarded as variations of points of view, and of emphasis; while other differences concern matters of method which are not mutually exclusive, but which are largely questions of very complex relativity. Sociologists will find very much to

applaud in this book, even though it diverges farther from the trunk-line of sociology, as some of them see it, than his earlier works.

The contents of the book are likely to be summarily and seriously misjudged by scholars in other sciences who merely give it casual notice. It seems to propose quantitative measurement of phenomena which obviously cannot be controlled, and to do the measuring by means of units which are both vague and variable. For instance, four types of individual character are posited: The forceful, the convivial, the austere, and the rationally conscientious. In an appendix the geographical distribution of these types in the United States is shown by an outline map shaded to correspond with the supposed predominance of the types respectively. The resident of Illinois, who finds himself in the 'austere' belt is provoked to inquire whether his previous impressions of miscellaneousness among his neighbors are utterly at fault. If he happens to live in Chicago, which, like other large towns, is classed as 'rationally conscientious,' he may turn to the text for the formula of himself and his fellow-townsmen. It runs in this fashion (p. 83): "This type is the product of a reaction against and progress beyond the austere character. It is usually developed out of the austere type. Like the austere, it is strongly conscientious, but it is less narrow in its interpretations of what constitutes harmful self-indulgence, and is more solicitous to attain complete development of all powers of body and mind. It enters all respectable vocations, but is much occupied also with liberal avocations, including literature, art, science and citizenship. Its pleasures are of all kinds, athletic, convivial and intellectual, including enjoyment of the arts; but all pleasures are enjoyed temperately." If one were disposed to be facetious, here is abundant occasion. But this is merely a sample of many features in the book which equally stimulate the sense of humor. Sceptics about sociology, who on general principles come to the book to scoff, will hardly remain to pray. They will pronounce the whole affair absurd. But his colleagues know that Professor Giddings is not a man given to absurdities, and

the very boldness of his drafts on their attention forbids snap-judgments. The clue in all these cases is to be sought in the difference between illustration and demonstration, and in the probability that Professor Giddings points out to his students, as scrupulously as any of his critics would, the approximate nature of such characterizations at best, and the limitations that must govern their application to masses.

But the sceptic will insist: 'What scientific value can there be in a method that deals with terms so inexact?' As will appear presently, my estimate of the relative importance of Professor Giddings' method for sociology is almost the inverse of his, yet whatever be the true ratio, sociologists ought to unite in testimony that they understand Professor Giddings, and that his program deserves scientific consideration.

The volume is divided into two books, entitled: I., 'The Elements of Social Theory'; II., 'The Elements and Structure of Society.' Book I. treats of the logical and methodological correlations of sociology with other divisions of knowledge. Though the author's individuality appears in these chapters at many points, the crux of the book is not in the prolegomena.

Book II. is divided into four parts, each containing four chapters. The titles are: Part I., 'The Social Population'; Part II., 'The Social Mind'; Part III., 'Social Organization'; Part IV., 'The Social Welfare.'

A disciple of the school of Schaeffle may be permitted to remark that, in spite of endless differences of detail, the outline which Professor Giddings draws from these points of departure connotes essentially the same fundamental ideas which 'Bau und Leben' developed. After all the contempt which has been heaped upon that work by men of other schools, such an independent and virile thinker as Professor Giddings is merely prospecting along the lines of Schaeffle's survey. This does not mean that Professor Giddings is either a conscious or an unconscious imitator. His originality is beyond question. It means that, up to a certain point, Schaeffle described the essential facts of society so truly that nobody

who studies society objectively can avoid representing the facts, provisionally at least, in forms which vary from his only in detail. Each new examination of the facts leads up to or builds upon an analysis substantially equivalent to his. Professor Giddings' conception of the things involved in general sociology is simply a variation of the 'General Theory of Forms and Functions (Social Morphology, Social Physiology, and Social Psychology),' contained in 'Bau und Leben,' Part I. The biological figures which Schaeffle uses so liberally are a mere accident. The relations which he formulates are the same reactions of persons upon persons which all sociologists must sooner or later take account of in substantially the same manner. Professor Giddings' hint (Preface, p. x), that while the present volume deals with 'only one-half of the field of general sociology' the other half, as he views it, consists of social genesis, corresponds with Schaeffle's second division, 'The General Theory of Evolution.' The teleological thread running through Professor Giddings' Part IV. is quite in the spirit of the telic theory that pervades Schaeffle's treatment. These facts are worth noting, as a commentary on the prevailing impression that sociology is merely a group-name for a litter of unrelated opinions. The sociologists have given occasion for this idea by magnifying the minutiae of their differences. All the while a consensus has been forming, which will presently justify itself as the framework within which our whole conception of life must be arranged. Distinct as are the individual elements in Professor Giddings' work, it should be said that they are incidents in the development of a common body of sociological doctrine, and that their value is in proportion to their compatibility with that containing whole.

Of the four parts of Book II., the first traverses well-worn ground of anthropology and ethnology, though not in the beaten tracks. The chapters are entitled: I., 'Situation'; II., 'Aggregation'; III., 'Demotic Composition'; IV., 'Demotic Unity.' In each of these chapters the author has made important suggestions as to the technique of the subject. For

reasons that will appear later, however, we may neglect details at this point, and speak more particularly of Part II. Though this portion occupies but 125 of the 302 pages in the whole work, it contains the most original features of the argument. The arrangement is as follows: I., 'Like Response to Stimulus'; II., 'Mental and Practical Resemblance'; III., 'The Consciousness of Kind'; IV., 'Concerted Volition.' While, for reasons to be stated in a moment, I do not believe that these chapters are properly sociology at all, and while I do not believe that they indicate the most advantageous passage out of psychology into sociology, they are brilliant and inspiring in almost every line. The psychologist, however, rather than the sociologist, is the competent judge of their contents. These reservations do not apply to the chapter on concerted volition. Its value, both as a stimulus of sociological research and as an indication of sociological and social demands upon psychology, would justify very emphatic praise.

Instead of entering upon microscopic examination, it seems better worth while to offer two cardinal criticisms of the book. It should be said in advance that, from the sociologists' point of view, the propositions to be urged against Professor Giddings charge sins of omission, not of commission. They recognize the positive service which his work has rendered, but they aim to fix its relation to the development of sociology in general. The first proposition accordingly attempts to place Professor Giddings' work more definitely than its author does, in correlation with other work. The second points out one of its limitations.

First then, as was hinted above, the work is primarily and predominantly not sociology, but ego-ology. Its vanishing point is not society, but the individual. As we have seen, Part I. of the argument proper (Book II.) is anthropology and ethnology. Three quarters of Part II. must be classed as psychology without benefit of society. To the layman this may appear a petty matter. What difference does it make whether the work bears the label of one shop or another, so long as it is good work? It really makes a great deal of difference. There either is or is not a need

of several kinds of shop. So long as the work is done indiscriminately in one, the same processes with the same tools being performed by different men; or so long as processes which require the technique of the shop are abridged by a right which assumption of a distinctive name is presumed to confer upon some outside workers, there is danger both that the work of the shop will be inferior, and that there will be costly delay about differentiating the shops. There are tremendous problems for workers in the sociological shop. They will not get their eyes fairly trained on those problems till they are willing to depend upon the workers in the psychological shop to mind their own business.

In the last analysis, Professor Giddings' view of the relations of anthropology and psychology to sociology probably do not essentially differ from those which prompt this criticism. The former sciences are absolutely necessary foundation-layers and tests of all sociological conclusions. The sociological interest is not however the anthropological or the psychological interest. Professor Giddings has nevertheless illustrated a very prevalent tendency among the sociologists to suffer seduction from their proper problems by interest in problems already claimed by other divisions of labor.

Professor Giddings devotes himself to making out, by a large number of differentia, the distinguishable physiological, intellectual, emotional and moral types of individual. Now I have not a word to say against the value of this work, nor do I question its ultimate bearing upon sociology. What I do urge, however, is that this is business for the anthropologist and the psychologist, while the sociologist would do better to make requisitions upon these specialists for information within their own field, and devote himself to statement and study of problems which, from his point of attention, are social first and individual second. It is certain that individual types of the sort which Professor Giddings suggests will never be made out with sufficient accuracy to have any scientific use, unless they are determined by the measurements of the appropriate laboratories. Sociologists would promote science very much faster if they would

devote the same amount of strength which they now expend in labors outside of their own field to creation of an effective demand for the labors of the proper specialists.

The point may be illustrated if I suppose myself an imitator of Mr. Howells' visitor from Altruria. Suppose I am an investigator from Utopia, where we will assume intercourse between persons is all purely spiritual, with no material aims or media. My astral body hovers over New York harbor, and my purpose is to find out as much as possible about the means and ends of what I hear the New Yorkers calling 'business.' I note certain differences in the craft plying in all directions. Suppose that, like Adam, I am inspired to apply fit names to the creatures; thus, canal-boat, ferry-boat, lighter, tug, dredge, excursion-steamer, tramp, liner, pilot-boat, coaster, fishing-smack, battle-ship, etc. Now suppose I make up my mind to enlarge my ideas of 'business' by taking these different craft as my clues, and that I proceed to hunt down the part which each type plays in 'business.' The present argument is that it would be more to the purpose for me to attempt this by starting with the registration and clearance papers of these craft, and by following them as they go about their several kinds of work, taking all preliminaries for granted, than it would be for me to probe back in the other direction, through the architectural construction of the craft, down to the chemical and physical properties of the materials so assembled. That is, if my immediate interest is traffic, it is poor economy for me to specialize on questions of marine architecture, and chemistry and physics. This is not to deny the relation of traffic to technical and pure science. Neither the science, on the one hand, nor the commercial knowledge on the other, will be complete till it is a synthesis of both; but it would be just as evident a mistake for me, in pursuit of knowledge of 'business' to concentrate my attention on pure science, as it would, if I were in pursuit of pure science, to concentrate my attention upon business.

Now to go back to Professor Giddings as a type of the sociologists. We shall never completely understand social reactions until we

understand the physiological, psychological, emotional, and moral composition of individuals. On the other hand, we shall never fully understand these elements until we entirely comprehend the social reactions in the course of which these elements are evolved. Meanwhile it is the fond folly of the philosophic temper to invert values, and plan to learn most about the thing that interests us most by neglecting it and studying most the thing that interests us least. It is not less fatuous because, forsooth, there is an ultimate interdependence between these objects of less and greater interest. Such reversal of a practical order amounts to a confession of unfaith in one's own appropriate scientific mission, and in that of others as well. Cannot other scholars be trusted to do their own work better than we can do it for them, and have we nothing to do which others have not fitted themselves to do as well? The strictly sociological questions center around *the fortunes of men in association*. The strictly physiological and psychological questions center around *the make-up of the persons associating*. Either of these groups of problems is a perfectly legitimate sphere of scientific interest. Neither of them is an exclusive sphere. Each runs into the other. It is, however, forsaking specialization for amateurism if the men whose center of interest is in the social sphere give their time to exploiting hypotheses in the individual sphere, and *vice versa*. As Professor Giddings assumes, in abundant and striking examples, in the chapter on concerted volition, the typical sociological questions are: How do men associate? For what purposes do they associate? How do they come to change the types of their associations? What are the reactions of the different types of associations upon the persons associating, and of the persons associating upon the different types of associations? Our answers to these questions will be false if we cut loose from the involved facts centering in the individual; but knowledge of these two phases of the common reality will have to grow through persistent use of the distinct centers of attention, not by abandonment of the one for the other.

For the sociologist to try to be at the same

time a successful ethnologist and a laboratory psychologist, in the hope of building up social facts from the elements, is hardly less naïve than the program which has been adopted and abandoned in disgust so many times by over-conscientious historians. They have decided to go back and find a point which they might take as absolute beginning of the evolution which they wanted to trace, and they have resolved from that point to clean up everything as they went along, leaving no unfilled gaps, and no unattached material. In practice they have been obliged to choose between forever pushing backward in search for the origin of the origins, or starting somewhere and tracing certain series of apparent evolutions, neglecting many factors that are doubtless concerned in the evolution, in order to be free to consider any series at all.

In actual experience, as contributors to knowledge rather than as middle-men, we must virtually choose in the same way, between physiology and psychology on the one hand and sociology on the other. Neither division of labor is going to succeed in cleaning up everything as it goes. Psychology will at one stage limp because it lacks support in sociology, and again sociology will be top-heavy because its center of gravity is not down close enough to psychology; but science will progress best if the sociologist sticks to sociology, and takes his psychology from the psychologists, instead of trying to be his own psychologist; and *vice versa*.

Professor Giddings is attempting to interpret society in terms of that abstraction which we called 'the individual' before we realized that it was an abstraction. This, I think, accounts for the fact which Professor Ross points out in a highly appreciative review of 'Inductive Sociology' (*Am. Jour. of Sociol.*, January, 1902), viz., that the title of Book II., Part II., Chap. II., 'Mental and Practical Resemblance,' is a misnomer. The chapter is a most sagacious qualitative analysis of individual traits, and a formal determination of types marked by the traits. Apparently, however, Professor Giddings' thought is in this form: "These traits in the individual, A, resemble the traits in the individuals B, C and

D. Therefore these like individuals make the type X." He consequently credits himself with classifying resemblances. If his viewpoint were strictly that of society rather than of the individual, he would see that he thereby checks off but a single step in his process. When he takes the next steps, and determines the types Y, Z and W, he does it by means of their differences from X and from each other. This is the longer and more important step and, as Professor Ross intimates, he should have designated it accordingly. The study of individuals is not sociology, any more than the study of bricks would be architecture. I would not prejudice my case by seeming to say that Professor Giddings has not studied sociology. He has of course for years been among the men who have studied it in all its dimensions. The present thesis is that the individual and the theory of the individual subtend too much of the angle of Professor Giddings' vision. The consequences are, first, that he does not draw a sharp methodological line between the sciences of the individual and the science of society; second, that his own work is, more than he is aware, on the individual side of the point where the division line ought to be; third, that the conclusions which he carries over to the social side of his thinking are arbitrary constructions of artificial individuals into a conventionalized social whole.

The second chief count against the book is that its organizing sociological conceptions belong in a period out of which sociology has definitely passed. As was said above, they are essentially the ideas of Schaeffle. To have thought Schaeffle's thoughts ten, or even five, years ago was a merit. Not to have thought beyond them to-day is a demerit. Professor Giddings' Part III., 'Social Organization,' and Part IV., 'The Social Welfare,' attempt precisely what Schaeffle attempted in the corresponding parts of his work. The results in the later instance do not suffer by comparison with the earlier, but no doubt Professor Giddings will be among the first to realize that a new idea is breathing the breath of life into the dead clay of structural and functional classifications. It should be admitted, in ex-

tenuation, that the only safe way to insure against the appearance of lagging behind the progress of sociological theory is to refrain from publishing a book. The movement of thought has been so rapid that an author is fortunate not to have outgrown his plan before his last chapter is in type. The probabilities are that Professor Giddings is no exception to the rule, and that the new impulse has exerted its full force upon him. It would be an injustice to hundreds of contemporaries in many divisions of science to credit this new impulse to any single individual; but Ratzenhofer has given it such detailed expression that it would not be at all strange if the present stage of sociological development were presently reckoned as dating from the appearance of 'Wesen und Zweck,' in 1893.

The center of gravity of the newer sociology is in the *interests* which move the machinery of association. Everything else becomes secondary. Instead of stopping with structural and functional formulas, as the last expressions of the social fact, we realize that societary structures and functions are merely vehicles of the essential content. The central reality in association is the evolution and correlation of interests. This perception produces a new critique of our whole structural and functional tradition. It furnishes a lens through which to see whether our sociological categories are elaborations of sterile technique, merely flattering its inventors, or whether they actually correspond with the interests which produce and operate and reconstruct the social forms.

Professor Simmel has lately remarked (*Inter. Monthly*, February, 1902, p. 183) that the real significance of historical materialism must be found in the fact that it is "the first attempt to explain history by means of a psychological principle. If hunger did not cause pain, if it were not, besides having its physiological function, a spiritual event, then it would never have set free the events that we call history." Anticipating the conclusion that 'historical materialism is altogether too narrow an hypothesis,' he observes two pages earlier: "The general synthesis that shall unite all the currents of existence as known to us

into consistent ideas, that shall convert all external reality into spiritual values, and satisfy all the needs of the spirit with the results of knowledge—this great synthesis we still await." All men who study life, and indeed all who live, will contribute to this synthesis. The sociologists have volunteered for a part of the work which is more general than that attempted by either of the older divisions of labor within the group of the positive sciences. It is nothing less than the frank attempt to achieve this synthesis. The most credible clue which they have discovered as yet is that the key to the interpretation of life is not one interest, but all interests. The immediate quest of the most alert sociology is a conspectus and a calculus and a correlation of the interests which actually impel real men. This quest is completely readjusting the sociological perspective. It is making us feel that we have been dealing with the stage-settings instead of the actors. It does not, and it cannot do away with knowledge of the mechanism of social structure and function, from the bodily tissues and mental traits of the units up to the conventions of world-society. It is beginning to enforce the conviction, however, that these are finally to be understood, not as their own interpreters, but as interpreted by the more vital realities, *i. e.*, the interests that produce and use them.

The change that has come over sociology is not unlike the shifting of attention in botany from the making of herbaria to the study of ecology. The change is taking us out of an atmosphere of isolated cases, on the one hand, and of desiccated metaphysics on the other, into the real life of men. We have to find out what men want, why they want it, in what proportions to other things that themselves and others want, how the wants depend upon each other, how association is related to these wants (the real passage from psychology to sociology), and how to appraise the same in settling upon a theory of the conduct of life. With this perception at the fore, our venerable structural and functional sociology begins to look like a treatise upon the instruments of Sousa's band by a man who had not found out what they are all for.

The conclusion of the whole matter is not that appreciation of Professor Giddings' book was promised at the beginning, only to be withdrawn at the end. The sort of work which the method proposes will have to be carried on by somebody until we have the kind of knowledge that it seeks. It requires the prevision and the courage of the seer to advertise a program which is sure at the outset to impress men in the exact sciences as quixotic. My conviction that analysis of interests and determination of interest-groups is more fundamental and more enlightening than classification of types on any less essential basis, makes me insist that Professor Giddings' program is not the most timely. It points, however, toward something which must sooner or later have its time. It is a powerful argument to the effect that the really fruitful work of psychology is virtually not yet undertaken. It should have the effect of a keen spur in promoting the development of both psychology and sociology.

ALBION W. SMALL.

The Microscope and its Revelations. By the late WM. B. CARPENTER. Eighth Edition, edited by W. H. DALLINGER. With 23 plates and nearly nine hundred engravings. Philadelphia, P. Blakiston's Son & Co. 1901. Price, \$8.00.

This standard work of reference has undergone another revision to keep it abreast the rapid advance in microscopical optics and construction during recent years. Two years ago with the appearance of the seventh edition the work was entirely rewritten, and while the changes now are less extensive they embrace the complete reconstruction of eight chapters, covering about one half of the 1,100 pages of the book. The portion rewritten treats of the principles of microscopical optics and of vision with the compound microscope, the history and evolution of the instrument and its accessories, the manipulation of apparatus, the preparation of objects and the application of the microscope to geological investigations. In this work the author has had the assistance of such well-known authorities as E. M. Nelson, A. B. Lee, E. Crookshank, T. Bonney, W. J. Pope, A. W.

Bennet, F. J. Bell and others, with the result that the volume will remain, as it has been, the most useful and extensive work of reference in this field. The illustrations, always numerous in former editions, have been largely increased and are excellently chosen.

Especial mention should be made of the chapter of 150 pages on the history and development of the microscope, the scientific presentation of which is full of interest; with its extensive illustrations, many of which are new, it forms by all odds the most complete study on the evolution of the present form of the instrument accessible to the student. Here is proposed the following scheme for the classification of instruments which makes their criticism and comparison more intelligible and constitutes the first effort in this direction. This classification is as follows:

Microscopes placed in Class I. possess—

1. Coarse and fine adjustments.
2. Concentric rotation of the stage.
3. Mechanical stage.
4. Mechanical substage.

Class II.

1. Coarse and fine adjustments.
2. Mechanical stage.
3. Mechanical substage.

Class III.

1. Coarse and fine adjustments.
2. Plain stage.
3. Mechanical substage.

Class IV.

1. Coarse and fine adjustments.
2. Plain stage.
3. Substage fitting (no substage).

Class V.

1. Single adjustment (coarse or fine).
2. Plain stage.
3. With or without substage fitting (no substage).

This classification applies also to portable microscopes.

Of American instruments Dr. Dallinger speaks very highly more than once, saying in one place, 'The recent microscopes of the best American makers are characterized by the highest quality of workmanship and abundant ingenuity,' and especially commending as an 'admirable feature' that the makers here "avoid sharp angles and knife-like edges on

all their instruments. This looks a trifle, but the use of the microscope with saprophytic, pathogenic or other infective material requires the utmost caution that the skin of the hands should be unbroken."

Dr. Dallinger's views on the continental model of stand are so well known that one can not be surprised at the position taken in this work; but the manner in which this opinion is expressed is so catholic and the criticism is so full of truth that the reader, whatever his views, feels himself brought into sympathy with the author. The following excerpt shows the tenor of this discussion:

Our one purpose in this treatise is to promote what we believe to be the highest interests of the microscope as a mechanical and optical instrument, as well as to further its application to the ever-widening area of physical investigation to which, in research, it may be directed. To this end throughout the volume and especially on the subject of the value and efficiency of apparatus and instruments, we have not hesitated to state definitely our judgment, and, where needed, the basis on which it rests. Incidentally we have expressed more than once our *disapproval*, and, with ourselves, that of many of the leading English and American microscopists, of the form of microscope known as the *Continental model*; we believe it is not needful to say that we have done this after many years of careful thought and varied practice and experience, and, so far as the human mind can analyze, without bias. It is not where a microscope is made that the scientific microscopist inquires first, but where it is made most perfectly. * * * The more recent instruments of Continental model are marvels of ingenuity. * * * There is no fault in the workmanship; it is the best possible. *The design alone is faulty*; there is nothing to command commendation in any part of the model. * * * To all who study carefully the history of the microscope and have used for many years every principal form, it will, we believe, be manifest that the present stand of the best makers is an overburdened instrument. Its multiplex modern appliances were never meant to be carried by it.

The chapters on the microscopic forms of life are extensive and well illustrated, yet they constitute the least satisfactory portion of the work; indeed some of the sections are seriously out of date. It is the lower types the

treatment of which is most evidently insufficient, and among the Protozoa, Cœlenterata and Vermes much recent work of great importance is omitted. Thus it is hard to see why the Flatworms, which are both of general and also of special clinical interest, should have been passed over with merely three pages of text and no illustrations; and the dismissal of malarial organisms by the citation in a brief footnote of a few authorities generally inaccessible, does not conform to the purpose of the work or to the manner in which other topics are handled. These are, however, instances from chapters of which a few have not been revised in either of the recent editions of the book.

In general the work has been carefully and thoroughly revised and brings together in convenient form a mass of valuable material which can hardly be found in any other single volume. It is indispensable to the amateur worker with the microscope who wishes assistance or information on the many problems which arise in his work, while biologists and others to whom the microscope is a professional instrument will find it a reference book of real value.

HENRY B. WARD.

PERNTER'S METEOROLOGICAL OPTICS.

AN important work on the optical phenomena that occur in meteorology is announced from the press of Wilhelm Braumüller, of Vienna, viz., 'Meteorologische Optik,' by Professor J. M. Pernter. This work is the fruit of the author's studies for twenty years past and represents the lectures that he has delivered to students in the universities at Innsbruck and Vienna. He proposes to thoroughly work over a field in the physics of the atmosphere that is often neglected by meteorologists, although in many respects of importance to those who are studying the dynamics of the atmosphere. Although treatises on meteorological optics have been published by Clausius, Mascart and others, yet, it is to be expected that this volume by Pernter will be the first that has done justice to the subject. The whole work will be divided into four sections, relating respectively to the apparent

shape of the celestial vault; the phenomena due to the gaseous components of the atmosphere, such as refraction and scintillation; those due to haze or cloud, such as halos, glories, rainbows and the colors of the clouds; finally, the phenomena due to very small particles of any kind always existing in the air, such as the blue color of the sky, the polarization of skylight, twilight and the absorption of light in the atmosphere. The first section, price 2 Kroners, or 45 cents, has already appeared, covering 54 pages of large quarto, and shows us that the whole work, which will embrace about 480 pages, is eminently worthy of commendation.

C. ABBE.

SCIENTIFIC JOURNALS AND ARTICLES.

Bird Lore for March-April opens with a most interesting article by William Brewster on the 'Voices of New England Marsh,' in which we are given a picture of the cycle of life throughout the year as indicated by the voice of the residents. The second article, on 'Bird Clubs in America,' is by S. N. Rhoads, and tells of the Delaware Valley Club. Edith M. Thomas contributes a poem on the 'English Starling,' and the third paper on 'How to Name the Birds,' by Frank M. Chapman, treats of the orioles and finches. Lawrence F. Love tells of 'My Bluebirds,' and we have reviews, editorials and the Audubon Department to complete the number.

The Osprey for March has 'Notes of some Yellow-throated Vireos' Nests,' by William R. Maxon; 'The Birds of the Marianne Islands and their Vernacular Names,' by W. E. Safford; 'Notes of McCown's Longspur in Montana,' by P. M. Silloway; 'The Carib Grassquit (*Euethia bicolor omissa*),' by B. S. Bowdish and a 'Biographical Notice of John Cassin,' by Theo. Gill, besides shorter articles and reviews. The supplement on 'The General History of Birds' continues the description of the feathers.

The Museums Journal of Great Britain has a brief article on 'Museums and Teaching,' which is rather flattering to American museums, an article by W. H. Edwards on 'An Economical Method of Mounting Shells and

other Small Objects for Museums,' and the fourth instalment of 'Hygiene as a Subject for Museum Illustration' gives the scheme of arrangement for the domestic, communal and dwelling divisions. There are a description of 'The Stone-Age Gallery,' British Museum, and a note on the 'Transvaal State Museum,' from which it appears that England has granted about £8,000 for its completion. If Great Britain can give this sum for this far-away Museum, it would seem as if the United States with its claim to be the richest nation in the world might provide a new National Museum.

The *American Museum Journal* for March contains an abstract of the annual meeting of its trustees, a note on 'A Fossil Armadillo from Texas,' the program for 'The International Congress of Americanists' and a note on the remarkable beetle, '*Hypocephalus armatus* Desmarest.' The 'Guide Leaflet' accompanying the number is by J. A. Allen and is devoted to 'North American Ruminants.' It comprises twenty-eight pages, an account of the group, containing much information, and is abundantly illustrated from living animals and from the museum groups. The title page and index to Vol. I. of the *Journal* is also issued.

SOCIETIES AND ACADEMIES.

BIOLOGICAL SOCIETY OF WASHINGTON.

THE 353d meeting was held on Saturday evening, April 5.

Frank Baker and F. A. Lucas discussed the question, 'Is the Area of Muscle Insertion an Index of Muscular Power?' Frank Baker stated that it had been assumed in discussing the flight of birds that because one bird had a larger area of wing muscle than another it necessarily exerted much more power in flight, while there were other points to be considered, such as the character or quality of the muscle fibers and their nerve supply. Dr. Baker then proceeded, with the aid of numerous lantern slides, to show that the internal structure of muscle varied much, so that one muscle might have vastly more power than another of equal bulk, while again there might be a vast difference in the contractile power of the individual fibers. The rapidity with which a muscle

might contract and relax, and the energy or force it might expend in doing this, would be influenced by the manner in which the nerves were distributed, and this, the speaker showed, varied very much. The powerful water beetles were cited as affording an example of peculiar nerve distribution probably correlated with the exercise of great strength, and it was stated that investigation would probably show that there were decided differences of nervation between birds of rapid flight and those slow of movement, and that other factors besides mere area of muscle insertion entered into the question of power exercised by flying animals.

F. A. Lucas, in presenting his side of the question, said that while he agreed with Dr. Baker that the area of muscle insertion was not necessarily a measure of muscular power, in certain cases he thought it might be. In estimating the amount of power expended by birds in flight, he had used the area of the keel of the sternum as a rough index of the force used. Mr. Lucas explained that in all birds the main muscles that raised and depressed the wings arose from the sternum and acted in the same way. In birds which flew by strokes of the wings, and whose flight was undeniably powerful, the breast muscles and sternal keel were in direct ratio to the apparent force, while the muscle insertions on the humerus were also large. In birds which sailed, like the albatross, the sternal keel and breast muscles were small. In certain birds, such as the tinamous, the quality of the muscle was poor, although the quantity was ample, and in such cases the character of the humerus and its small attachments for muscles showed that such was the case. The speaker illustrated his remarks by diagrams of the humeri of various birds, and one showing the sternum of the albatross as it actually was and as it would be did the albatross employ a force proportionate to that of the humming-bird, concluding that he felt justified in using the size of the sternum in birds as a measure of the power used.

W. P. Hay presented a paper on 'The Subterranean Fauna of the United States,' illustrating his remarks with lantern slides. He showed the areas in which caverns occur, described the manner in which caverns are

formed and showed examples of various types of caves. The cave fauna was discussed in detail and compared with that of Europe. With the exception of one salamander, related to *Proteus* of Europe, and one crustacean the species of cave animals were stated to be related to, or obviously modified from existing forms of the regions in which the caverns are located.

F. A. LUCAS.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 550th meeting was held March 29, 1902.

Mr. Marcus Baker discussed this geometrical proposition: 'If one corner of a cube be cut off by an oblique plane the sum of the squares of the areas of the three faces adjacent to the corner is equal to the square of the area of the opposite side.' This can easily be proved analytically; but as the relation requires four dimensions, and no geometrical proof is known, the speaker held the relation was merely numerical. Professor Gore concurred in this view.

Mr. G. K. Gilbert presented the geophysical problem of the pressure of a glacier on its bed at a point below the surface of the sea, and the contradictory solutions that had been given.

The first regular paper was by Professor J. H. Gore, on 'The Ambiguity of the Double Sign' \pm occurring in the extraction of roots. He pointed out that ordinarily we determine by experience which of these signs is the true one in a specific case; but in cases outside of experience we have no criterion to guide our judgment. This was illustrated by various examples.

Mr. C. K. Wead then spoke on 'The Theory of some Peculiar Musical Instruments in the National Museum.' The instruments included the globular four-hole whistles from Costa Rica, figured by Messrs. Wilson and Upham in the 'Museum Report' for 1896, and similar less perfect whistles in other museums, and various kinds of primitive flutes. The scales produced on these are only by accident diatonic, and the laws clearly are applicable to the instrument, not to the notes. A new generic principle of primitive scale-making was enunciated, and various specific forms of the principle. The fuller statement of these laws will soon appear

in the 'Report of the U. S. National Museum' for 1900.

Mr. Upham then exhibited several of the instruments and performed on them. The type whistle or resonator gave very closely the notes F (690 d. v.), A, C, D, E.

THE 551st regular meeting was held April 12, 1902.

The election to membership of Mr. S. W. Stratton, of the Bureau of Standards, and Mr. W. J. Spillman, of the Department of Agriculture, was announced.

The paper of the evening was on 'Liquid Air,' by Mr. G. A. Bobrick, superintendent of the only establishment furnishing liquid air commercially. The consumption is now about 150 gallons per week; the carriers are so well insulated that a gallon will not wholly evaporate under about a month, and recent improvements have largely diminished the loss from their fragility. The well-known experiments were fragility to show the effects of intense cold, -312° F., on various kinds of bodies, and the use of the liquid for explosives and to promote combustion. Apparatus was exhibited showing the production of the lime light by gas and liquid air. The history of the liquefaction of gases during nearly a century was given, with brief description of the three processes used; the bent tube (Davy), the cascade or closed double cycle (as by Pictet), and the self-intensive or regenerative systems. This last in practice yields a pound of liquid air per pound of coal used.

The speaker finds this an ideal source of power, where the expense is not prohibitive: seventeen gallons drives his automobile fifty to sixty miles. While it will never be used for stationary engines, it will be useful for submarine and aerial navigation. It is used in manufacturing chemicals and food extracts, and has already important medical uses.

CHARLES K. WEAD,
Secretary.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the meeting of the Society on April 9, Mr. S. F. Emmons read parts of an address delivered by Clarence King in June, 1877, on the thirty-first anniversary of the Sheffield

Scientific School, entitled 'Catastrophism and the Evolution of Environment.' This address was a protest against the extreme views held in those days by the British schools of uniformitarians headed by Lyell. With his own peculiar delicacy of touch, Mr. King first sketched the origin of the adverse schools of catastrophists and uniformitarians, and showed that they differed not so much in regard to the facts of geology as to the rate of geological change. He then stated that in his recent 30,000 miles of geological travel on the Survey of the 40th Parallel he found that geological history, as he read it, showed not the often unvarying rate of change of the uniformitarian, but periods of calm interrupted by others of accelerated change that in their effect upon life must have been catastrophic in their nature.

In response to man's questioning as to his origin, he said Nature vouchsafes one syllable of answer at a time. The syllable that Darwin got was the Natural Selection. Biologists consider it necessary to deny catastrophism in order to save evolution and reason only from the continuity of the paleontological record, neglecting the evidence of physical breaks in the geological record; but the latter must have varied the rate of geological change and thus brought a modified catastrophism. Natural Selection resolves itself into two laws: *heredity* and *adaptivity*, the latter being the accommodation to circumstances, which is dependent, half upon organism, and half upon the environment. Environment has affected the evolution of life during rapid movements of the crust or sudden climatic changes, either by extermination, by destruction of the biological equilibrium, or by rapid morphological changes on the part of plastic species. At the end of a period of uniformitarian conditions there has been a period of accelerated change in which only the more plastic forms have survived. In the future the geologists must therefore take into account periods of modified catastrophism, King says, and concludes in the following words:

"Moments of great catastrophism thus translated into the language of life, become forms of creation when out of plastic organ-

isms something new and nobler is called into being."

Mr. F. L. Ransome spoke on 'Faulting and Mountain Structure in Central Arizona.'

The district discussed is in the Globe Quadrangle, lying in the sierra region which borders the Colorado Plateau on the southwest. Paleozoic quartzites and limestones rest unconformably on pre-Cambrian schists and granites, and all of these rocks are extensively intruded by diabase. After a long erosion interval, effusive rhyolites were erupted, probably during the Tertiary. The region was then deformed by a remarkably numerous series of normal faults. The rocks are divided into countless small fault-blocks and the prevailing structure is monoclinical, the Paleozoic beds dipping southwest at an angle of about twenty-five degrees. The strata are nowhere folded and the mountains are due to faulting, although the external forms of the faulted blocks have been considerably modified by erosion.

ALFRED H. BROOKS,
Secretary.

TORREY BOTANICAL CLUB.

At the meeting of the Club on March 26, 1902, the first paper was by Dr. L. M. Underwood, entitled 'Notes on *Goniopteris*.' Distinguishing features, found in the venation and in the form of the indusium, were illustrated by figures. Nine species were mentioned, chiefly of the West Indies, including *G. reptans* of Florida, and species recently collected in Porto Rico and in St. Kitts.

The second paper was by Dr. M. A. Howe, 'Notes on the Marine Flora of Nova Scotia and Newfoundland.' Numerous examples were exhibited, illustrating especially the larger Phæosporeæ, including rolls of dried *Laminaria*, rock specimens bearing crustaceous species, and many others preserved in jars or by mounting in sheets. Among noteworthy species or forms found were *Fucus serratus*; *Fucus vesiculosus* without vesicles on the Nova Scotia coast; *Stipocaulon* at Pictou, the first discovery in North America of this genus of the Sphacelariaceæ. Examples were shown of *Laminaria longicruris* and *L. platymeris* from the Newfoundland coast whence De la

Pylaie first described them. Interesting specimens of *Agarum*, *Alaria*, *Porphyra*, *Gloiophonia*, etc., were exhibited, the *Agarum* from a deep tide-pool at Digby covered by thirty feet of water at high tide. Corallines attain great beauty in these northern waters, and with the attendant brown rockweeds and lustrous kelps lend great richness and diversity of color. The dulse gatherers were found to distinguish and prefer the dulse growing on *Laminaria* to that attached to rocks. Dulse gathering at Pictou forms a business of considerable importance; the dried dulse is put up in barrels to be sold in Boston and latterly in New York.

A third communication, by Dr. MacDougal, consisted of the exhibition and discussion of a specimen of *Ephedra*, one of two species collected by him in his recent trip to Arizona. This remarkable leafless relative of the pines produces palisade cells along its stems instead of leaves. A living cutting about three feet high was shown resembling Scotch broom in its multitudes of long green and brown branches.

Dr. MacDougal also exhibited a remarkable Arizona plant, perhaps an *Ipomœa*, with large swollen discoid base about fifteen inches in diameter, to which short roots were still attached. He had also collected there the tree *Ipomœa* known as the 'Palo Blanco' tree, on which deer browse; it bears a few flowers all the year round, but the leaves disappear after the rainy season.

EDWARD S. BURGESS,

Secretary.

UNIVERSITY OF WISCONSIN SCIENCE CLUB.

At the meeting of the Club held on April 1, Professor R. W. Wood, of Johns Hopkins University, addressed the Club on the subject 'A Suspected Case of the Electrical Resonance of Minute Metal Particles for Light Waves,—A New Type of Absorption.'

Small pieces of sodium, lithium or potassium heated in air-exhausted glass bulbs deposit on the cold wall of the bulb in the form of a film which shows colors by transmitted light as strong as those produced by the aniline dyes. The color does not seem to depend on the thickness, and all attempts to explain it by the well-known principles of interference have been without

success. The microscope shows that the deposit is made up of exceedingly minute grains, which are but just barely visible under a one twelfth inch oil immersion objective. Their diameter is not far from .0002 mm. The colors vanish on the admission of the smallest trace of air. They change in a most remarkable manner if the outside of the bulb be touched with a small piece of ice, or if the glass be locally heated. The change of color produced by the application of ice to the outside of the bulb is always in the direction corresponding to a drift of the absorption band towards the red end of the spectrum. A purple film which has an absorption band in the yellow becomes blue-green when cooled, the absorption band moving into the red.

The cause has been found to be a condensation of the traces of volatile hydrocarbons (derived from the metal) on the colored film, thus immersing the particles in a fluid of high dielectric constant, the effect of which would be to increase the capacity of the system, lower the period of vibration, and move the region of absorption towards the red end of the spectrum. This was proved by forming the film in one half of a double bulb and immersing the other half in solid CO₂ and ether, thus bringing down all the hydrocarbon vapor. The colored film was found to be no longer sensitive to the local application of ice. It became sensitive, however, as soon as the lower bulb was removed from the freezing mixture and warmed. Sometimes the film becomes nearly colorless when cooled, the absorption band moving out of the visible spectrum entirely. Films originally pale apple green become deep violet when cooled, the color being as deep as that of dense cobalt glass. Various experiments have been tried with polarized light at different angles of incidence.

The paper will appear in full in the *Proceedings of the London Physical Society* and the *Philosophical Magazine*. C. K. LEITH.

DISCUSSION AND CORRESPONDENCE.

THE MATHEMATICAL THEORY OF THE TOP.

TO THE EDITOR OF SCIENCE: 'The Mathematical Theory of the Top,' kindly communicated for me by Professor Barus to SCIENCE of

December 20, 1901, is simplified much further by noticing that, as the velocity of H is $Wgh \sin \vartheta$ perpendicular to the plane OGK , the hodograph of H (turned backwards through a right angle) is similar to the projection on a horizontal plane of the path of a point C on the axis of the top; and thus

$$Wgh \sin \vartheta e^{\psi t} = -i \frac{d}{dt} (\rho e^{\pi t})$$

by which the vector of the projection of C is derived from the herpolhode curve described by the vector OH of resultant angular momentum by means of a simple differentiation; and this holds for the general top, not merely the symmetrical. I take this opportunity of calling attention to some misprints:* as μ for u , and p for the Weierstrassian symbol in equations (32) to (40).

A. G. GREENHILL.

ORDNANCE COLLEGE,
WOOLWICH, ENG.,
April 7, 1902.

STEINER'S 'LOST' MANUSCRIPT OF 1826.

IN 1826 Steiner announced that he had a manuscript, 'Über das Schneiden (mit Einschluss der Berührung) der Kreise in der Ebene, das Schneiden der Kugeln im Raume und das Schneiden der Kreise auf der Kugelfläche,' ready for print. The subject of this paper, treated by a mathematician like Steiner, has always been considered as of fundamental importance for the development of the geometry of the circle. Since the death of Steiner (1863) until recently, all efforts of recovering this celebrated manuscript were in vain. In 1896, on the occasion of the centennial celebration of Steiner's birthday, in Bern, Dr. Bützberger found a box in the garret of the library of the Naturforschende Gesellschaft in Bern, containing several manuscripts of Steiner, among which was also the one supposed to be lost.

This fact is also interesting in connection with Professor Fiedler's (Zürich) investigations on cyclography for which he received the Steiner prize from the Berlin Academy of Science. In a recent letter to the writer, Fiedler remarks that he was in possession of the principles of cyclography (treatment of geometrical problems by means of circles) already in

* These have already been corrected (see SCIENCE, XV., p. 440).—EDITOR.

1863, and that he waited for the publication of Steiner's collected works by Weierstrass in 1881, because he expected to find in it said paper and Steiner's corroboration of his (Fiedler's) results by a similar method. The inspection of Steiner's manuscript, found in 1896, shows however that it does not contain the slightest trace of Fiedler's method. Fiedler is therefore the founder of cyclography.

UNIVERSITY OF COLORADO. ARNOLD EMCH.

AN UNPUBLISHED LETTER BY RAFINESQUE.

TO THE EDITOR OF SCIENCE: During the residence of C. S. Rafinesque in Sicily, after his first four years' stay in America, he was in frequent correspondence with American botanists. From them he constantly sought for collections of local plants, offering Sicilian and other European plants in exchange. The letters were written by Rafinesque during the period of greatest mental strength and activity, and hence seem to illustrate certain phases of his mental life in a most interesting and instructive manner. Letters of this period seem to be quite rare and the following, presented me in copy by Mr. Curtis G. Lloyd, of Cincinnati, with permission to use it as I should wish, seems to well illustrate in the case of Rafinesque his methods of enriching his own herbarium. So far as I have any information in the matter, Rafinesque always fully repaid these exchange debts—thus setting a most commendable example to others who may be 'less eccentric' than the Sicilian botanist. The letter was written to Dr. Manasseh Cutler, then of Massachusetts, but more recently of Ohio, and seems to confirm our general view that Rafinesque was an inveterate collector and that he used every known honest means to increase the number of sheets in his herbarium. The letter was written in 1806 and is interesting of itself. I send it to you, thinking some readers of SCIENCE may be interested in it through their knowledge of the 'eccentric naturalist.'

BROOKLYN, N. Y., R. ELLSWORTH CALL.
March 29, 1902.

PALERMO, 2nd May, 1806.

Dear Sir:—

I confirm what I had the pleasure to write

you per Alfred Capt. Felt, and another opportunity offering for Salem I cannot help entreating you again to have the goodness to comply with my request of collecting and sending me some of your most curious plants and particularly such I have pointed out in my former letters, the numerous opportunities from Salem and Boston to this place will afford you every facility in forwarding me same.

I am still expecting to hear from you if you got the plants I left for you at Francis Hotel and how you like them. If you have an European Herbarium or wish to make one I am ready to forward you specimens of the finest and nicest Italian and Sicilian plants in return from those I expect from you and beg you will command in everything else in my power.

Please to remember also to forward me Suplt. you promised me of the plants you have found in your Northern States since the publication of your paper in the American Academy Transactions.

I would entreat you to include in the plants you may send me, particularly those belonging to the tribe of Orchidean, Graminean, Calamariæ, Muci, Algæ, etc., as they are particularly interesting to me and I know you have well determined a number of them through Dr. Muhlenberg's means.

I should like to know the botanical names of all your Cherries, Vacciniums, etc., or a sketch of their descriptions (since you only mentioned their vulgar name in said paper) to enable me to discover it if you cannot send them in nature with the fruits or flowers.

I am most sincerely and with the most grateful wishes,

Dear Sir,

Your most obedient servant,

C. S. RAFINESQUE,

Care Mr. Bibbs Conpit,

Un Admer.

DR. MANASSEH CUTLER,

Hamilton,

Near Salem,

Massachusetts.

avored by Mr.

Th. Bancroft.

Palermo.

'NODULES' IN COLORED BLOOD CORPUSCLES.

'Nodules' in mammalian colored corpuscles, such as those referred to by Professor Macloskie, were described by Mr. Victor Horsley, of London, in an address delivered on May 4, 1897, at a meeting of the 'Arztlicher Verein' at Hamburg. He did not, however, observe them in all the corpuscles, but only in some. In his paper, published, I think, in one of the volumes of collected papers from the Physiological Laboratory of University College, London, he mentions that Arndt saw granules in the red corpuscles which stained with methyl violet. Horsley's own observations were made by the intra vitam methylene blue method. In connection with my work on haemolysis, carried on during the past five years, I have had frequent opportunity to observe that when methylene blue is added to blood laked in various ways, blue granules generally situated eccentrically are revealed in some of the ghosts. G. N. STEWART.

A MUD SHOWER.

TO THE EDITOR OF SCIENCE: On Saturday, April 12, at noon there occurred what has aptly been called a 'mud shower.' Collars and shirt fronts were spattered with dirt. It lasted only a few minutes, but was sufficiently unpleasant to create considerable discomfort. Window glasses on the western exposure of houses were covered with thousands of drops of dirty water. An examination of these drops with a simple microscope showed what appeared to be little membranous bags containing grains of dust. The dust particles were black with occasional instances of yellow and a few of red. The atmosphere at the time of the shower, and before, contained considerable dust. This phenomenon seems to give a striking confirmation of the dust-nuclear theory of the formation of rain drops. J. W. MOORE.

LAFAYETTE COLLEGE,
EASTON, PA.

THE 'PRICKLY PEAR.'

TO THE EDITOR OF SCIENCE: On page 598, issue of April 11, 1902, is printed the item that the Government of Queensland has offered a reward of \$25,000 for the invention of some satisfactory means of destroying the 'prickly

pear.' If this refers to the common Missouri cactus, would it not be well to follow the Mexican in making it a useful food for cattle and sheep, by cutting the plant to the ground, and throwing it on piles of dry brush, which are fired, and the spines scorched off, when it is greatly relished by the stock.

CHARLES H. STERNBERG.

LAWRENCE, KANSAS.

THE SONG OF BIRDS.

TO THE EDITOR OF SCIENCE: Some time ago Mr. W. E. D. Scott contributed to SCIENCE an article upon the song of birds, drawing the conclusion that when isolated from their kind birds would originate a song.

In the building in which my office is located there is a canary that was taken from its parent bird when quite young, and grew to adult age entirely isolated from other birds. It has developed a song of its own made up, as nearly as I can distinguish, of but three tones sung as a phrase of seven notes. While the song suggests that of the ordinary canary it is not, I would say, actually any part of it; it is sometimes used singly, though generally repeated several times, and there is little if any variation from the original phrase or form.

WALTER S. KELLEY.

THE CONGER EEL.

TO THE EDITOR OF SCIENCE: The U. S. National Museum has recently received from the New York Aquarium a specimen of the larval form of the conger eel, which was captured in Gravesend Bay, N. Y. It measures four inches in length and is in a good state of preservation. Another specimen recently sent to the Aquarium was taken on the New Jersey coast.

Although the adult conger eel is common in New York waters, the *Leptocephalus* form has been recorded but rarely. Brevoort recorded its occurrence in the vicinity of New York City many years ago.

BARTON A. BEAN.

U. S. NATIONAL MUSEUM,

WASHINGTON, D. C.,

April 25, 1902.

CORRESPONDENCE OF THE LATE PROFESSOR LEIDY.

TO THE EDITOR OF SCIENCE: The undersigned has been collecting for some time the correspondence of the late Professor Joseph Leidy. Before the same is published, he would be indebted for any such which may be in the possession of the readers of SCIENCE. Care will be taken to return the originals if requested.

Kindly address,

DR. JOSEPH LEIDY.

1319 LOCUST STREET,
PHILADELPHIA, PA.,
April 21, 1902.

SHORTER ARTICLES.

THE HYDROLYSIS AND SYNTHESIS OF ETHYL BUTYRATE BY PLATINUM BLACK.

KASTLE and Lowenhart have shown that the catalytic action of the enzyme lipase is reversible, *i. e.*, that it accelerates not only hydrolysis of fats into fatty acid and alcohol, but also the synthesis of fats from fatty acids and alcohol (*Chemical News*, February 8, 1901–March 15, 1901).

In an investigation on the action of enzymes which I began over a year ago at the suggestion of Professor Loeb, it occurred to us to try experiments with platinum black as the active principle in place of lipase.

I found that platinum black acts quite comparably to lipase. Platinum black hydrolyzes ethyl butyrate as well as synthesizes it from butyric acid and ethyl alcohol.

In my experiments the following chief facts were found:

1. Platinum black hydrolyzes ethyl butyrate, as is shown by the constant and definite increase in the acidity of the solution.
2. The velocity of the action is a function of temperature, *i. e.*, an increase in temperature from 0°C. to 40°C. is accompanied by a correspondingly increased hydrolysis.
3. The velocity of the reaction is a function of the quantity of the platinum black used; but independent of the quantity of ethyl butyrate used.
4. Platinum black synthesizes butyric acid and ethyl alcohol into ethyl butyrate. The odor of ethyl butyrate appears in a short time and increases with the increase in time.

5. The catalytic action of platinum black is diminished through the addition of small quantities of those poisons which, according to Kastle and Lowenhart, interfere with the catalytic action of lipase, *e. g.*, potassium cyanide, hydrogen cyanide, phenol, mercuric chloride, salicylic acid, silver nitrate, chloroform, sodium fluoride and others.

In all the experiments bacteriological precautions were used to exclude the possible influence of bacteria in these results. Control experiments showed that the above hydrolytic and synthetic action did not occur in the absence of platinum black.

My sincere thanks are due Professor Loeb for his helpful and valuable suggestions in these experiments.

A full report of these experiments will appear in the *American Journal of Physiology*.

HUGH NEILSON.

HULL PHYSIOLOGICAL LABORATORY,
UNIVERSITY OF CHICAGO,
April 12, 1902.

THE JACKSON OUTCROPS ON RED RIVER.

THE Jackson stage of the marine Tertiary appears on the Red River in Louisiana at three points, known to the writer from recent inspection. The northernmost outcrop is the well-known long low bluff at Montgomery, which is probably the most extensive and prolific exposure of the stage now existing. The fossils are contained in profusion in a light blue-gray argillaceous marl, the bed being some six feet in thickness and having a very pronounced even dip, through the approximately quarter mile of exposure, of about one foot in fifty along the straight course of the river, which is here nearly due south, until it disappears beneath the surface at low water.

The next exposure occurs about a mile and a half below the Montgomery outcrop, on the estate of Mr. T. W. Kimbrel. These beds, which are also exposed along a line bearing but a few degrees east of south, have so slight a dip that they appear to be practically horizontal to the eye and are composed for the greater part of greenish-black and brick-red clays. This deposit is not so rich in species as the Montgomery bed and is much more

limited in horizontal extent; it bears nearly due south from the Montgomery bed.

The third exposure occurs at the eastern base of the high and very picturesque bluff, more than a mile in length, about three miles below the Kimbrel beds and limiting the estate of Mr. John Young, and is in like manner composed of blackish and red clays; it bears about thirty degrees south of east from the Kimbrel deposits and may be known as the Young's Bluff bed. Both the Kimbrel and Young's Bluff beds are characterized by a profusion of a large *Pinna* and of *Venericardia planicosta*, *Volutilithes* and *Pseudoliva*.

The Kimbrel bed belongs to a horizon noticeably distinct from the Montgomery outcrop and contains immense numbers of an extremely minute *Lucina*, which is without doubt one of the smallest known bivalves. It is suborbicular, generally a little higher than long, slightly inequilateral, with the posterior side more broadly rounded than the anterior, strongly inflated, thick and heavy in substance, with the hinge thick and strong, all the cardinal teeth large, and the lateral teeth also very thick and almost equidistant from the cardinal. The beaks are small and moderately elevated, the lunule long, narrow and rather ill-defined. The ventral edge is crenulate within and the exterior surface marked with feeble close-set lines of growth and generally also three or four deep concentric grooves of arrested growth. The length of the largest valve in an extended series is 1.35 mm., the height 1.4 mm. It may be called *Lucina atoma*, and is brought forward with a name at the present time because of its importance in being the characteristic fossil of the Kimbrel horizon.

It is impossible at present to state the number of feet of strata separating this horizon from the Montgomery, for it is probable that the latter stratum changes its dip shortly after disappearing below low water, but there are several changes in the nature of its fossils that indicate considerable lapse of time. This is shown, for example, in *Venericardia planicosta*, in which the hinge seems to be less developed and the substance of the entire shell thinner, and in *Volutilithes*, where the

columella usually has two folds instead of the three which is the prevailing state at Montgomery. These differences also hold good with the same species as found in the Young's Bluff bed, which must be very nearly synchronous with the Kimbrel bed, but the former is nevertheless sufficiently distinct in horizon to have developed another characteristic species of *Lucina*, occurring there very abundantly. It is also very minute, though a little larger than *atoma* and may be named *perminuta*.

This species is suborbicular, generally a little longer than high, less inflated than *atoma* and much thinner in substance, similarly inequilateral and more broadly rounded behind, with the lunule much deeper and more evident and only slightly more than twice as long as wide. The hinge is much thinner and the lateral teeth are similarly placed, but much weaker. The ventral edge is similarly crenulate and the external surface has much more evident close-set and sublamelliform lines of growth, the deep grooves of arrested development, when present, being generally limited to the ventral portions. The length of the largest valve before me is 1.55 mm., the height 1.45 mm.

It is probable that these two species, together with such forms as *smithi* and *choc-tavensis*, should be considered generically distinct from *Lucina*.

The bed at Montgomery contains myriads of the very small pelecypod *Alveinus minutus*, which may be considered one of its characteristic species when comparing it with the upper horizons, but no example of *Kelliella battgeri* Meyer—characteristic of the deposits at Jackson, Miss.—or of the two minute *Lucinae*, characterizing the overlying Kimbrel and Young's Bluff beds, could be found. In the Kimbrel deposit *Alveinus minutus* becomes extremely rare and one specimen of the *Kelliella* was obtained. Neither could be found in the Young's Bluff outcrop, although this was not so thoroughly examined.

In venturing upon a suggestion of correlation with the beds at Jackson, Miss., it seems proper to consider the Montgomery outcrop as virtually synchronous with the Dry Creek

deposit, and the Kimbrel bed as well above the Moody's Branch beds. The Young's Bluff bed is still higher, but neither seems to have developed any of the purely Red Bluff species, although lithologically they both appear to be somewhat similar to that well-known deposit in Mississippi. As these greenish-black clays are however similar to those which also characterize so much of the Lower Claiborne in Louisiana, very little can be inferred from such resemblances. In fact, lithological characters stand for very little in the strata of the southern Tertiary, except in a few instances and the paleontological are the only ones that can generally be depended upon.

THOS. L. CASEY.

ST. LOUIS, MISSOURI,

March 11, 1902.

THE NOMENCLATURE OF THE MONOPHLEBINE COCCIDAE.

WORKING over the Monophlebinae for Wytsman's 'Genera Insectorum,' I find myself able to recognize six genera out of about fifteen which have been proposed. These are *Monophlebus*, *Stigmacoccus*, *Lophococcus*, *Palæococcus*, *Walkeriana* and *Icerya*. At present I am unable to separate *Crypticerya* from *Palæococcus* and the latter is connected by lately discovered forms with *Walkeriana*, so that it becomes difficult to indicate sharp generic limits. These insects are very widely distributed and ancient forms, going back at least to the Tertiary, one species occurring fossil at Florissant.

Mr. Newstead, in describing *Walkeriana pertinax* (P. Z. S., 1900, p. 948), says he at one time 'thought the insect might form the type of a new genus under the name *Aspidoproctus*,' but has decided for the present to leave it in *Walkeriana*. Now this creature forms at least a good section or subgenus for which we need a name. I am taking up *Aspidoproctus*, as of Newstead, but am a little uncertain whether I have the right to do it. I should like to have the opinion of other naturalists, whether a name introduced as cited is to be regarded as published. *Gymnococcus* Douglas was introduced in the same way and is now current.

Some other new sections have been found necessary. *Mimosicerya*, with 9-jointed female

antennæ, includes *Palæococcus hempelæ* (Ckll.). *Monophlebulus* with 7-jointed female antennæ, includes *Monophlebus fuscus* Maskell. The Linnean *Coccus cacti* becomes *Monophlebus cacti*. Maskell's supposed *Monophlebus burmeisteri* from Japan (*Trans. N. Z. Inst.*, XXIX., p. 237) becomes *M. maskelli* and belongs to the section *Drosicha*.

T. D. A. COCKERELL.

SCIENTIFIC NOTES AND NEWS.

A RECEPTION in honor of Lord and Lady Kelvin was given at Columbia University on the evening of April 21. Over 2,000 guests were present, including many eminent men of science. Professor F. B. Crocker presided, and addresses of welcome were made by President Nicholas Murray Butler on behalf of Columbia University, by Professor Elihu Thomson on behalf of the Institute of Electrical Engineers, by Professor A. G. Webster on behalf of the American Physical Society, and by Professor R. S. Woodward on behalf of the American Association for the Advancement of Science and other societies. Lord Kelvin replied in an address about half an hour in length, in the course of which he referred to his several visits to America and the great progress that had been made by this country in the applications of electrical science. Lord Kelvin is expected to visit Cornell University on May 2, where he will address the students and attend a reception given by Dr. R. H. Thurston, dean of Sibley College. Lord Kelvin appeared before a congressional committee on April 24, to advocate the bill introducing the metric system of weights and measures.

MR. M. H. SAVILLE will return to New York in May after a successful winter's work of excavation in the Zapotecan tombs of Cuilapam near Oaxaca, with the Loubat Expedition of the American Museum of Natural History.

PRESIDENT A. S. DRAPER, of the University of Illinois, has in view of his illness been given leave of absence by the trustee.

PROFESSOR F. L. WASHBURN, of the University of Oregon, has been elected state ento-

mologist of Minnesota, succeeding the late Otto Lugger.

THE Board of Health, New York City, has increased the salary of Dr. Hermann M. Biggs from \$2,500 to \$5,000 per year, and changed his official title from director of the bacteriological department to medical officer.

COMMISSIONER LEDERLE, of the Board of Health of New York City, has given out the following appointments to honorary officers: Daniel Draper, Ph.D., consulting meteorologist; George Henry Fox, dermatologist; Stevenson Towle, sanitary engineer; Clarence C. Rice, M.D., laryngologist; Arthur B. Deuel, M.D., attending otologist, and George F. Schradly, M.D., consulting surgeon.

DR. CHARLES K. MILLS, professor of nervous diseases in the University of Pennsylvania, gave a dinner at the University Club, Philadelphia, on April 13, in honor of Dr. William Aldren Turner, of London, the neurologist, and his brother, Dr. Logan Turner of Edinburgh, the laryngologist. They are the sons of Sir William Turner, the eminent anatomist of the University of Edinburgh.

LETTERS have been received from Mr. Harry de Windt, who is attempting to make a land expedition across Bering Strait. At the end of February he was on the upper Yana River, six hundred miles north of Yakutsk.

MR. S. M. VAUCLAIN, General Superintendent of the Baldwin Locomotive Works of Philadelphia, and inventor of the Vauclain Compound Locomotive, lectured before the engineering societies of Lehigh University on Thursday evening on 'The Locomotive.'

THE committee of the Medical School of the Johns Hopkins University, appointed to erect a memorial to the late Dr. Jesse William Lazear, who lost his life as the result of an experiment on the transmission of yellow fever, reports that sufficient money has been subscribed to erect a memorial tablet and to establish a library fund for the purchase of works relating to tropical diseases.

J. STERLING MORTON, ex-Secretary of Agriculture, died at his home at Lake Forest on April 27.

M. ALFRED CORNU, the eminent physicist, since 1867 professor at the *École polytechnique*, Paris, has died at the age of sixty-one years.

THE American Mathematical Society, at its recent meeting in New York City, authorized the establishment of a section of the Society on the Pacific coast. It is expected that the new section will be organized at San Francisco on May 3.

THE Royal Geographical Society, London, has established a gold medal for geographical research, to be called the Victoria medal. The first award has been made to Mr. E. G. Ravenstein for his work in scientific cartography, and especially for his map of east central Africa.

THE Catalonia Academy of Medicine, at Barcelona, offers a prize of about \$500 for the best essay on the comparative histology of the fovea centralis, to be received before the end of the present year.

THE marine laboratory which the Prince of Monaco has built at Monaco is now nearly complete, and will soon be ready for use. It is understood that naturalists of all nationalities will be welcomed to work at the laboratory and that the equipment will be very complete.

MR. ANDREW CARNEGIE has informed the mayor of Stratford-on-Avon that he will defray the total cost of a library and reading-room for the town if the corporation will provide a suitable site.

WE have already noted the bill before Congress appropriating \$10,000 to establish a biological station on the Great Lakes. Professor Jacob Reighard, to whom the movement is chiefly due, writes as follows in regard to the importance of the station:

The purpose of such a station would be as follows: (1) The investigation of the problems connected with the fisheries of the Great Lakes throughout their extent. Such work should be largely experimental like that of the agricultural experiment stations. These problems are:

(a) Breeding times, places and conditions of the fishes.

(b) Food, feeding habits, feeding grounds and

the migrations of the immature and adult commercial fishes.

(c) The enemies of the commercial fishes.

(d) Special studies of the whitefish and sturgeon, which are decreasing and of the carp which have been recently introduced and enormous increase of which appears a serious problem and is a possible danger to the other fishes.

(e) A careful study of the general biological conditions surrounding the fishes and which appear to be favorable for their growth and development.

Such work is a necessity not only for successful artificial propagation but for a proper framing of suitable fisheries laws. Such work should be carried on year after year in connection with the regular work of the United States Fish Commission, for the reason that it is not only germane to its investigations but essential to the success of its operations and to the prosperity and increase of the commercial fisheries. Just as the National Government supports large numbers of experimental stations in the interests of agriculture, so should it support such a station in the interest of fish culture, an *aquacultural* experimental station.

MRS. C. P. HUNTINGTON and Archer M. Huntington, Esq., have provided liberally for the continuation of the work begun in 1899 by the Anthropological Department of the American Museum of Natural History, New York, among the Indians of California, through the liberality of Mr. Collis P. Huntington. Some of the results of the work already accomplished by the Huntington expedition among the California Indians have been published this winter in the *Bulletin* of the Museum by Dr. Roland B. Dixon. The 'Basketry Designs of the Indians of Northern California' is the title of the first of the series of publications issued by this expedition.

DR. EDGAR A. MEARNs, Surgeon U. S. Army, to whom the Museum is already indebted for many thousand specimens, has recently donated to the department of conchology a large series of specimens illustrating the littoral molluscan fauna of the vicinity of Newport, Rhode Island. Through the generosity of Percy R. Pyne, Esq., the Museum was enabled in March to purchase two unpublished paintings of birds by John J. Audubon. The subjects of these paintings

are the Myrtle Warbler and the Red-Eyed Vireo.

MR. J. C. STEVENS, the London auctioneer, sold on April 14 the entomological and scientific library of the late Miss E. A. Ormerod, and on April 15 and 17 parts of the collections of butterflies and birds' nests and eggs formed by the late Philip Crowley.

THE American Congress of Tuberculosis will meet in New York City at the Hotel Majestic, on May 14, 15 and 16.

THE Second International Congress for Electricity in Medicine and Radiography will be held at Berne from September 1 to 6, 1902.

THE Astronomical Society of France held its annual meeting on April 12, under the presidency of M. H. Poincaré, who made an address on the progress of astronomy during the year 1901.

THE New York *Evening Post* quotes as a serious piece of news the following from a London Journal:

"Another American marvel, though in a totally different direction, is Will Gwin, the boy surgeon. Before he could walk he was present at all the operations his father—himself a clever surgeon—undertook, and not long ago he gained his certificate at the New Orleans University, the examiners stating that he was the cleverest osteologist they had ever met. Though only six years of age, he is consulted by patients whose age is ten times his own, and his income runs well into four figures."

UNIVERSITY AND EDUCATIONAL NEWS.

MR. JOHN D. ROCKEFELLER has given \$1,000,000 to promote the cause of southern education. It is understood that it will be distributed among educational institutions by the Southern Educational Conference, newly organized by Mr. Robert C. Ogden, of New York City.

PLANS have been completed for the new buildings of the College of the City of New York to be erected on Amsterdam Avenue and 138th and 139th Streets, at a cost of \$2,100,000. Five buildings are planned, in-

cluding a mechanical arts building and a chemical laboratory.

AMHERST COLLEGE has received a gift of \$15,000 for the endowment fund, the income of which is to be used to increase the salaries of instructors and associate professors.

THE committee of the corporation of Harvard University appointed last December to report on the University Library has recommended the construction of a new library building to cost about \$650,000.

THE department of geology of Cornell University will conduct field work for ten weeks, the headquarters of the school being in the Helderberg mountains, near Albany.

MR. W. C. BRAY, of the University of Toronto, has been awarded the '1851 exhibition traveling scholarship' for research in chemistry.

DR. RAYMOND DODGE, associate professor of philosophy at Wesleyan University, has been appointed professor of psychology.

DR. JAMES LOCKE, of Yale University, has been called to an assistant professorship of chemistry in the Massachusetts Institute of Technology.

MR. M. DE K. THOMPSON, assistant in the Rogers Laboratory of the Massachusetts Institute of Technology, has been appointed instructor in electro-chemistry, with leave of absence to study abroad.

A two years' course in pharmacy and a four years' course in pharmaceutical chemistry have been added to the college curriculum of North Dakota Agricultural College. Mr. Charles H. Kimberly, of Ohio University, has been elected instructor in pharmacy. Miss Marie B. Senn, professor of domestic science, resigns at the close of college year.

DR. UHLIG has been appointed professor of physiology in the University at Vienna, and Dr. Haussner, of Giessen, professor of mathematics in the Technical School at Karlsruhe. Dr. Max V. Vintschagau, professor of physiology in the University at Innsbrück, has retired.